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A new species of the genus *Gekko* Laurenti (Squamata: Sauria: Gekkonidae) from Guangxi, China

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Abstract

A new species of the genus *Gekko* is described on the basis of six specimens from Wuming county of Guangxi, southern China. *Gekko kwangsiensis* sp. nov. is distinguished from other congeners by a combination of the following characters: body relatively small (SVL 64.2–69.7 mm in adults), slender; nares in contact with rostral; internasal absent or single; postmentals two (rarely three), enlarged; interorbital scales between anterior corners of the eyes 29–31; dorsal tubercle rows 9–11; ventral scales between mental and cloacal slit 185–208; midbody scale rows 143–156; ventral scale rows 41–45; subdigital lamellae on first toe 11–13, on fourth toe 13–18; finger and toe webbing weakly developed; tubercles absent on upper surface of fore limbs and hind limbs; precloacal pores nine or ten in males, absent in females; postcloacal tubercle single; tubercles present on dorsal surface of tail base; subcaudals enlarged; dorsal surface of body with 9 or 10 thin light bands between nape and sacrum, and dorsal surface of tail with remarkable black and white bands. Data on the natural history of the new species are provided, and the number of species in the genus *Gekko* recorded from China is now 17.

Key words: *Gekko*, taxonomy, Guangxi Zhuang Autonomous Region

Introduction

The genus *Gekko* Laurenti currently comprises about 51 species, which are common inhabitants of plains and plateaus across temperate and tropical Asia and the western islands of Oceania (Zhou & Wang 2008; Rösler *et al.* 2011; Uetz & Hošek 2014). Rösler *et al.* (2011) divided the members of *Gekko* into six species groups: *G. gekko*, *G. japonicus*, *G. monarchus*, *G. petricolus*, *G. porosus*, and *G. vittatus* groups on the basis of morphological and preliminary molecular phylogenetic data. The *Gekko japonicus* group is the most diverse group in the genus with a total of 20 recognized species and a wide distribution in eastern Asia, from Japan throughout eastern China southward to Vietnam (Rösler *et al.* 2011; Nguyen *et al.* 2013). The members of this group are characterized by a moderate size; nares usually in contact with rostral; 2–3 nasals; 0–21 rows of dorsal tubercles; 0–32 precloacal pores; 1–4 postcloacal tubercles; the webbing between fingers and toes weakly developed to extensive; lateral folds without tubercles; enlarged subcaudals; and vertebral region with large, light flecks, blotches or bands (Rösler *et al.* 2011).

During recent field work in the karst forests of Guangxi Zhuang Autonomous Region, southern China, we collected six individuals of an unknown species of the genus *Gekko*, which can be assigned to the *Gekko japonicus* group based on morphological features. It differs significantly from all congeners by a combination of morphological and color characteristics and described as new species herein.

Methods and material

Six individuals were collected from Wuming County, Nanning City, Guangxi Zhuang Autonomous Region, China. All specimens are preserved in 80% alcohol and deposited at the herpetology collection of Kadoorie Farm and Botanic Garden, Hong Kong (KFBG).

Measurements are as follows: SVL = snout vent length, from tip of snout to anterior margin of cloacal; TailL = tail length, from posterior margin of cloaca to tip of tail; AG = distance between axilla and groin; HL = head length, from tip of snout to posterior margin of ear opening; HW = maximum head width; HH = maximum head height; OD = orbit diameter, SE = distance from snout tip to anterior margin of eye; EE = distance between posterior margin of eye to posterior margin of ear opening, RW = rostral width, RH = rostral height, MW = maximum mental width, ML = maximum mental length. Measurements were taken with a digital caliper to the nearest 0.1 mm. Scallation characters are as follows: SPL = supralabials, IFL = infralabials, N = nasals (in direction from rostral to labial: nasorostrals, supranasals, postnasals), I = internasals (scales between nasorostrals in contact with rostral), IO = interorbitals (number of scales in a line between anterior corners of eyes), CS = spinous ciliaries, PO = preorbitals (number of scales in a line from nostril to anterior corner of the eye), PM = postmentals, GP = number of gular scales bordering posterior margin of postmental scales, DTR = dorsal tubercle rows, GSDT = granules surrounding dorsal tubercles, SMC = scales along underside of body from mental to the front of cloacal slit, SR = scales around the middle of the body, V = ventrals, scales across the venter between the ventrolateral folds at midbody, LF1 = subdigital lamellae under the first finger, LF4 = subdigital lamellae under the fourth finger, LT1 = subdigital lamellae under the first toe, LT4 = subdigital lamellae under the fourth toe, PP = precloacal pores, PAT = postcloacal tubercles, S3W = dorsal scale rows in the middle of the third caudal whorl. Bilateral scale counts are given as left/right.

Systematics

Gekko kwangsiensis sp. nov.

Figs. 1–3

Holotype. KFBG 14076, adult male, from Wuming County, Nanning City, Guangxi Zhuang Autonomous Region, China, collected on 10 July 2013 by J.H. Yang and Sheng Zheng.

Paratypes: Five paratypes: two adult males KFBG 14074–75; one adult female KFBG 14077; one subadult female KFBG 14078; one subadult male KFBG 14079; data identical to the holotype.

Diagnosis. *Gekko kwangsiensis* sp. nov. can be distinguished from other congeners by a combination of following characters: body relatively small (SVL 64.2–69.7 mm in adults), slender; nares in contact with rostral; internasal absent or single; postmentals two (rarely three), enlarged; interorbital scales between anterior corners of the eyes 29–31; dorsal tubercle rows 9–11; ventral scales between mental and cloacal slit 185–208; midbody scale rows 143–156; ventral scale rows 41–45; subdigital lamellae on first toe 11–13, on fourth toe 13–18; finger and toe webbing weakly developed; tubercles absent on upper surface of fore limbs and hind limbs; precloacal pores nine to ten in males, absent in females; postcloacal tubercle single; tubercles present on dorsal surface of tail base; subcaudals enlarged; dorsal surface of body with 9–10 thin light bands between nape and sacrum, and dorsal surface of tail with remarkable black and white bands.

Description of holotype. Body slender, SVL 64.2 mm, TaL 76.5 mm, AG 29.0 mm; head longer than wide (HL 17.4 mm, HW 13.8 mm); rostral rectangular, wider than high (RW 3.0 mm, RH 1.4 mm) and wider than mental (MW 2.3 mm), without mid-dorsal notch, touching nostril; supralabials 12/13; nares in contact with rostral, first supralabial and three nasals (nasorostral, supranasal, postnasal); nasorostrals enlarged, in contact with each other; supranasal slightly smaller than postnasal; internasal absent; snout medially with flat, elongate cavity; lateral snout scales oval, somewhat convex, two times larger than those in interorbital region; preorbitals 19/19; interorbitals 31; pupil vertical; upper ciliary scales two times as large as medial snout scales, six/five spinous tubercles posteriorly; a skin fold running from the last supralabial posteriorly to about one third way to tympanum; ear opening oblique, oval, about 36% of the eye diameter (maximum tympanum diameter 1.6 mm, horizontal eye diameter 4.4 mm), with a skin fold above; nuchal scales granular, as large as those in interorbital region; temporal region with 2–3 tubercles anterodorsal to ear opening; mental triangular, wider than long (MW 2.3 mm, ML 1.9), slightly larger than first infralabials; infralabials 12/13; postmentals two, enlarged, twice as long as wide, and longer than mental, in contact with mental and first infralabials anteriorly, medial suture between postmentals about the same length as mental; postmentals in contact with four gular scales posteriorly; dorsal tubercles 3–4 times as large as adjoining dorsal scales, round to oval, convex, smooth, surrounded by eight to ten dorsal scales

(mainly nine), in ten semi-regular longitudinal rows at midbody; lateral fold weakly developed, without tubercles; ventrals between lateral folds 42; scales around midbody in 148 rows; ventral scales in a line between mental and cloacal slit 195; scales on upper and lower arm slightly enlarged; tubercles absent on dorsal surface of forelimbs and hindlimbs; scales on anterior and ventral parts of thigh larger than those on dorsal and posterior parts; enlarged femoral scales absent.

TABLE 1. Measurements (in mm) and scalation characters of the type specimens of *Gekko kwangsiensis* **sp. nov.** (Abbreviations defined in text).

	KFBG 14074	KFBG 14075	KFBG 14076	KFBG 14077	KFBG 14078	KFBG 14079
Sex	Adult male	Adult male	Adult male	Adult female	Subadult female	Subadult male
SVL	69.7	64.2	64.2	65.5	53.8	54.1
TaL	79.7	75.2	76.5	76.2	59.3	60.2
AG	29.1	32.6	29.0	23.4	25.3	26.3
HL	19.1	17.2	17.4	17.6	15.1	14.2
HW	14.4	13.4	13.8	13.1	11.2	11.5
HH	7.7	7.6	7.6	7.3	6.0	6.0
OD	4.7	4.5	4.4	4.5	3.7	3.5
SE	8.4	7.9	7.9	7.8	6.5	6.3
EE	6.6	6.1	6.6	6.4	5.3	4.6
RW	2.8	3.0	3.0	3.0	2.5	2.3
RH	1.6	1.3	1.4	1.4	1.1	1.3
MW	2.3	2.3	2.3	2.4	2.0	1.9
ML	1.7	1.3	1.6	1.4	1.3	1.3
SPL	12/12	10/10	12/13	11/12	12/11	10/10
IFL	12/12	12/11	12/13	13/13	13/13	11/12
N	3/3	3/3	3/3	3/3	3/3	3/3
I	0	1	0	1	1	0
IO	29	30	31	29	30	30
CS	9/7	5/5	6/5	8/6	9/6	7/6
PO	19/20	19/18	19/19	18/19	19/18	19/18
PM	2	2	2	2	2	3
GP	6	6	4	4	5	4
DTR	11	9	10	10	10	10
GSDT	8–10	8–9	8–10	8–10	8–9	8–10
SMC	185	203	195	208	190	200
SR	144	143	148	156	150	145
V	43	41	42	44	45	41
LF1	10/10	11/11	12/11	12/13	12/12	12/12
LF4	12/12	13/12	14/13	14/14	13/12	14/13
LT1	11/12	12/13	13/13	13/12	11/11	12/11
LT4	13/14	15/15	16/15	15/14	15/15	16/18
PP	9	10	10	Absent	Absent	10
S3W	10	10	9	10	10	11

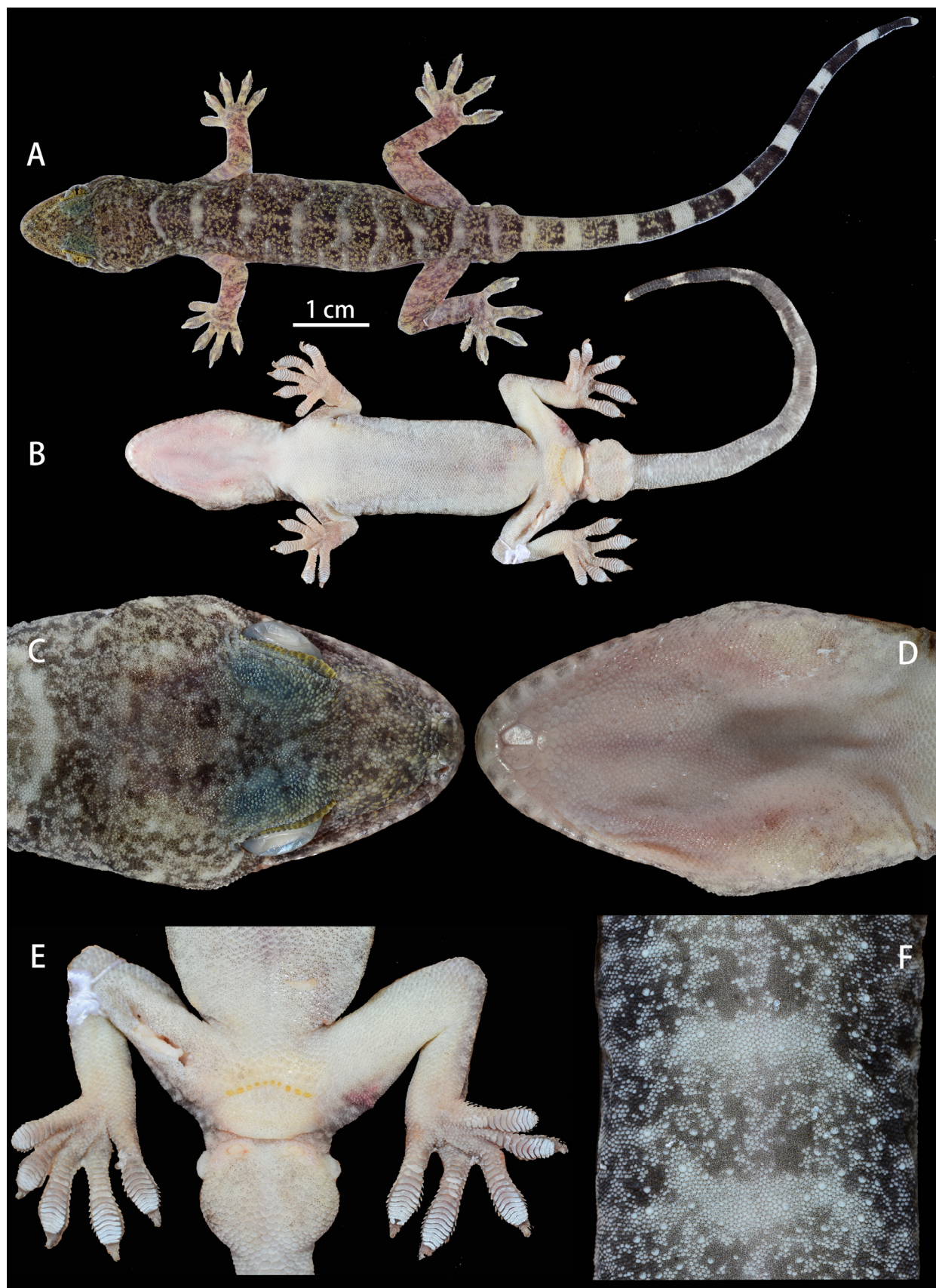


FIGURE 1. Holotype of *Gekko kwangsiensis* sp. nov., KFBG 14076: A: dorsal view in life; B: ventral view of body and tail; C: dorsal view of the head; D: ventral view of the head; E: precloacal region and ventral view of tail and hindlimbs; F: dorsal scalation at midbody, note smooth, convex, enlarged rows of tubercles.

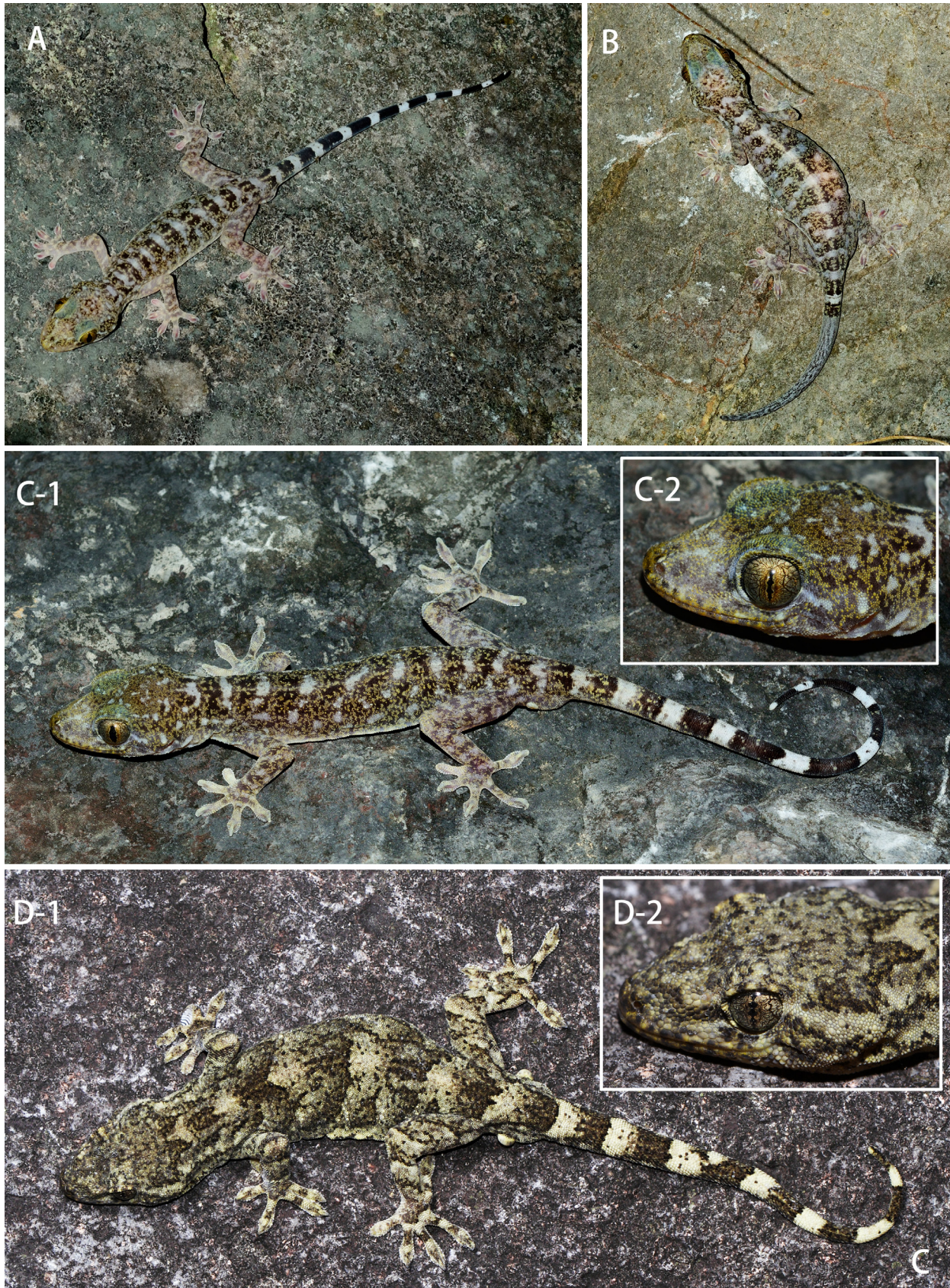


FIGURE 2. A–C: *Gekko kwangsiensis* sp. nov. in life; A: KFBG 14075, adult male; B: an adult gravid female with regenerated tail, not collected; C: KFBG 14074, adult male; D: *G. hokouensis* in life, from Hekou (= Hokou) Town, Yanshan County, Jiangxi Province, China (type locality).

Limbs well developed, digits moderately dilated, clawed except the first digit; fingers and toes webbing weakly developed; claws sheathed by 3 scales; undivided subdigital lamellae under first finger 12/11, under fourth finger 14/13, under first toe 13/13, under fourth toe 16/15; precloacal pores ten, in an angular series; enlarged scales posterior to precloacal pores in four rows; a single postcloacal tubercle, blunt; tail distinctly swollen at base, with some tubercles on dorsal surface of tail base; dorsal caudal scales approximately twice the size of dorsal scales of trunk, squarish, flat, in regular transverse rows; third whorl nine dorsal scales in width; subcaudals flat, enlarged, arranged in a longitudinal row.

Coloration in life: Ground colour of head and body greyish brown; snout and interorbital region vermiculate; some small light spots present in head, temporal region and lateral sides of neck; supralabials and infralabials mottled like head with narrow whitish vertical bars on edge of scales; dorsum with nine thin, wide light bands between nape and sacrum; some short light bars along lateral sides between limb insertions; limbs light grey with indistinct light greyish brown bars; ground colour of tail solid black, with nine immaculate light bands; throat, venter, and precloacal region immaculate yellowish-cream; under surface of tail dark grey (Fig. 1).

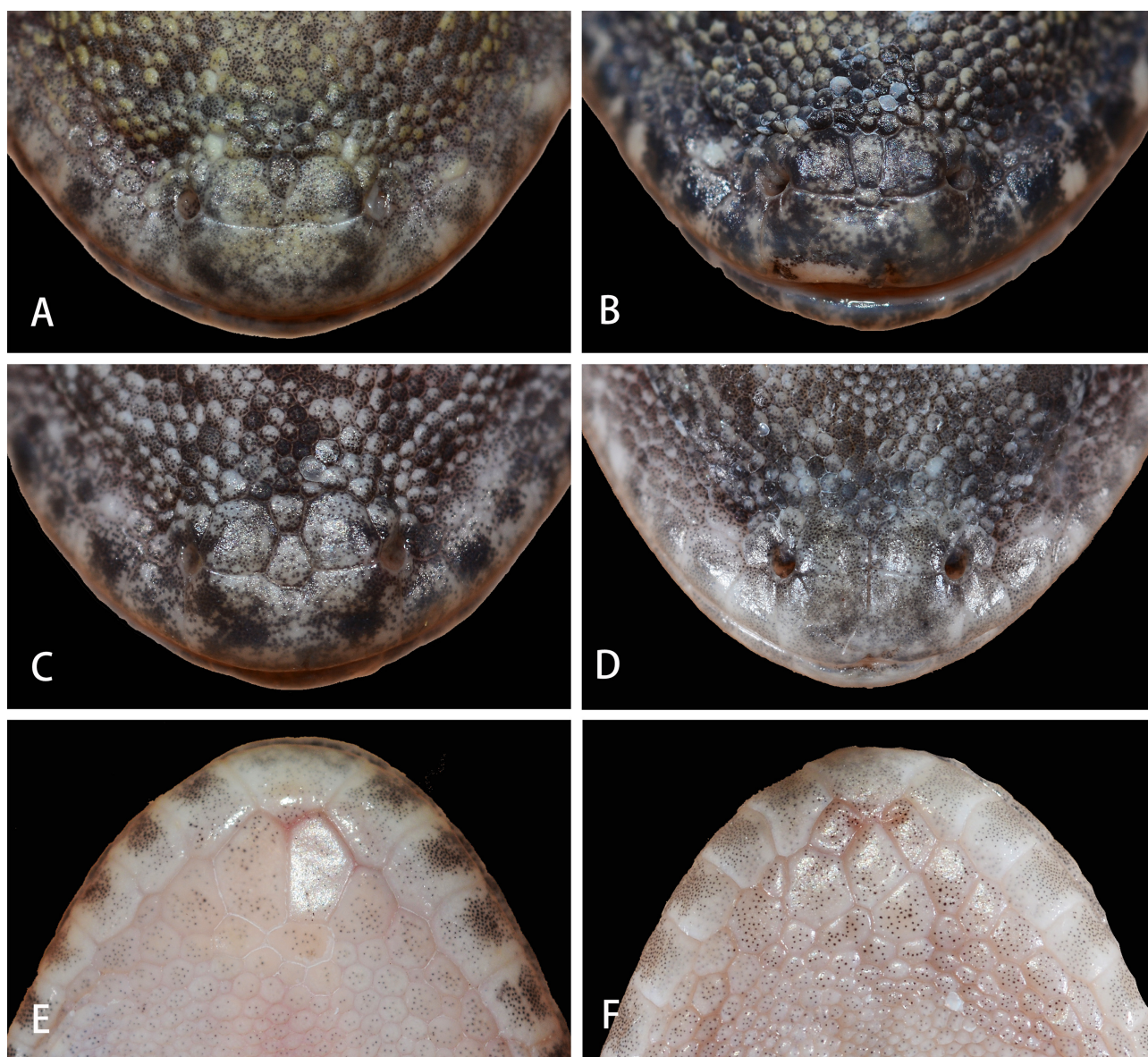


FIGURE 3. A: snout tip of the holotype KFBG 14076; B: snout tip of the paratype KFBG 14077, note the small internasal, and separated nasorostrals; C: snout tip of the paratype KFBG 14078, note the small internasal, and separated nasorostrals; D: snout tip of the paratype KFBG 14079, note the rostral with mid-dorsal notch; E: ventral view of chin of the holotype KFBG 14076; F: ventral view of chin of the paratype KFBG 14079, note three postmentals.

Variation. The five paratypes basically match the holotype in overall scalation and coloration characters (Fig. 2). Variation in meristic and mensural characters among the type series is given in Table 1. Male paratypes have 9 or 10 distinct preloacal pores, which are absent in females; postloacal tubercle distinctly enlarged in males, relatively smaller in females; a small internasal present in three paratypes (KFBG 14075, 14077–78), but variable in size: internasal extremely small in KFBG 14075, small (about 1/8 of the size of nasorostral) in KFBG 14077, relatively large (about 1/3 of the size of nasorostral) in KFBG 14078 (see Fig. 3); nasorostrals in contact with each other in four type specimens, but separate in two paratypes KFBG 14077–78 (Fig. 3); juvenile male paratype KFBG 14079 has mid-dorsal notch present in rostral (absent in other type specimens), and three enlarged postmentals (two in other specimens). Nine light dorsal bands between nape and sacrum in KFBG 14076 and 14078, ten in KFBG 14074–75, 14077 and 14079.

Etymology. This new species, “*kwangsiensis*”, is named after its type locality, Guangxi Zhuang Autonomous Region, China (Kwangsi is the former spelling of Guangxi). For the common name, I suggest “Kwangsi Gecko”.

Distribution and natural history. The species is currently known only from Wuming County, Guangxi Zhuang Autonomous Region in southern China (Fig. 4). The new gecko species is a rock-dwelling specialist, all individuals were found on the karst rocks in secondary-growth forest edge (at an elevation of 340 m a.s.l.) at night. Three gecko eggs, most likely of *Gekko kwangsiensis* **sp. nov.**, were found in a rock crevice.



FIGURE 4. Map showing the type locality of *Gekko kwangsiensis* **sp. nov.** (star): Wuming County, Nanning City, Guangxi Zhuang Autonomous Region, China.

Comparisons. I compare *Gekko kwangsiensis* **sp. nov.** with all 20 currently recognized species within the *G. japonicus* species group. In having tubercles on dorsum, *Gekko kwangsiensis* **sp. nov.** can be easily distinguished from *G. melli* (Vogt), *G. scientiaventura* Rösler, Ziegler, Vu, Herrmann & Böhme, *G. subpalmatus* (Günther) and *G. tawaensis* Okada, versus dorsal tubercles absent in these species. In having a single postloacal tubercle, *Gekko kwangsiensis* **sp. nov.** can be easily distinguished from *G. auriverrucosus* Zhou & Liu (2–3), *G. canhi* Zhou & Liu (2–3), *G. japonicus* (Schlegel) (2–4), *G. scabridus* Liu & Zhou (2–3), *G. scientiaventura* (2–3), *G. swinhonis* Günther (2–3), *G. taibaiensis* Song (3), *G. tawaensis*, *G. vertebralis* Toda, Sengoku, Hikida & Ota (1–2) and *G.*

wenxianensis Zhou & Wang (2–3). In having 9–10 distinct preloacal pores in males, *Gekko kwangsiensis* **sp. nov.** can be easily distinguished from *G. adleri* Nguyen, Wang, Yang, Lehmann, Le, Ziegler & Bonkowski (17–21), *G. chinensis* (Gray) (17–27), *G. palmatus* Boulenger (23–30), *G. scabridus* (10–15, usually 12–13) and *G. similignum* Smith (17), as well as *G. shibatai* Toda, Sengoku, Hikida & Ota, *G. tawaensis* and *G. vertebralis* (adult males lacking distinct preloacal pores in these three species).

From the remaining species, *Gekko kwangsiensis* **sp. nov.** differs from *G. hokouensis* Pope in having more preloacal pores (9–10 *versus* 5–9, usually 6–7 in *hokouensis*), more preorbitals (18–19 *versus* 13 in *hokouensis*), fewer dorsal tubercle rows (9–11 *versus* 12–14 in *hokouensis*), more subdigital lamellae under first and fourth toes (11–13 *versus* 6–9 and 13–18 *versus* 7–9, respectively, in *hokouensis*), and a different dorsal pattern. *Gekko kwangsiensis* **sp. nov.** differs from *G. liboensis* Zhou, Liu & Li in having a relatively smaller body size (adults SVL 64.2–69.7 mm *versus* 76–85 mm in *liboensis*), fewer interorbitals (29–31 *versus* 40 in *liboensis*), more subdigital lamellae under first and fourth toes (11–13 *versus* 8 and 13–18 *versus* 9, respectively, in *liboensis*), dorsal tubercles round and convex (*versus* dorsal tubercles round and flat in *liboensis*), and a different dorsum pattern. *Gekko kwangsiensis* **sp. nov.** differs from *G. yakuensis* Matsui & Okada in having more preloacal pores (9–10 *versus* 6–8 in *yakuensis*), dorsal tubercles present on the dorsal surface of tail base but not extending posteriorly (*versus* paired median tubercles present on the whole length of the original tail in *yakuensis*), and a different dorsal pattern.

Discussion

With the description of *Gekko kwangsiensis* **sp. nov.**, the total number of species in the genus *Gekko* recorded in China is 17 species: *G. adleri*, *G. auriverrucosus*, *G. chinensis*, *G. gekko* (Linnaeus), *G. hokouensis*, *G. japonicus*, *G. kwangsiensis* **sp. nov.**, *G. kikuchii* (Oshima), *G. liboensis*, *G. melli*, *G. reevesii* (Gray), *G. scabridus*, *G. similignum*, *G. subpalmatus*, *G. swinhonis*, *G. taibaiensis* and *G. wenxianensis* (Zhao *et al.* 1999; Rösler *et al.* 2011; Nguyen *et al.* 2013).

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