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A new red-eyed *Gekko* (Reptilia: Gekkonidae) from Kanchanaburi Province, Thailand

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Abstract

A new species of gekkonid lizard, *Gekko nutaphandi*, is described from Kanchanaburi Province in central western Thailand. It is a member of the large-bodied *Gekko gecko* group and within this group is probably most closely related to *G. siamensis* Grossmann & Ulber, 1990 with which it shares a similar dorsal pattern of transverse series of white spots on a drab background. It differs from *G. siamensis* in its greater number of precloacal pores, lower number of dorsal tubercle rows, and in having red (versus green) eyes. Comparisons are also made with several other nominal *Gekko* species currently synonymized with *G. gecko* and with undescribed, but well-characterized "forms" of *G. gecko*. The new species is one of many recently described Southeast Asian geckos that appears to be restricted to limestone habitats and their surroundings.

Key words: *Gekko*, Gekkonidae, Thailand, description, *Gekko gecko* group, limestone

Introduction

Geckos of the genus *Gekko* Laurenti, 1768 are members or a relatively large, putatively monophyletic group of lizards that also includes *Lepidodactylus* Fitzinger, 1843, *Luperosaurus* Gray, 1845, *Pseudogekko* Taylor, 1922, and *Ptychozoon* Kuhl & van Hasselt, 1822 (Kluge 1968; Russell 1972; Bauer *et al*., unpublished). The genus *Gekko* itself is species rich (38 species) and is generally characterized by regional endemism across its broad range in tropical Asia. Diversity is particularly high in the Philippines (Brown & Alcala 1978; Gaulke 2003; Rösler *et al.* 2006; Brown *et al.* 2008) and China (Zhou *et al.* 1982; Zhao *et al.* 1999; Du *et al.* 2002; Zhou & Wang 2008). More widespread species of *Gekko* may, in fact, represent complexes of cryptic species. The broadly distributed *G. vittatus* Houttuyn, 1782, for example, is believed to comprise several similar, but spefically distinct taxa (Crombie & Pregill 1999), and *G. melli* Vogt, 1922 has recently been removed from the synonymy of the widespread *G. subpalmatus* Günther, 1864 (Rösler & Tiedemann 2007), whereas several new species have been recognized in the *G. hokouensis* group (Toda *et al.* 2008). Likewise, *G. verreauxi* Tytler, 1864 was resurrected from the synonymy of *G. smithii* Gray, 1842 and *G. taylori* Ota & Nabhitabhata, 1991 (synonym of *G. siamensis* Grossmann & Ulber, 1990) was described, in part, on the basis of its chromosomal distinctiveness from other populations then considered to be *G. smithii* (Ota 1989; Ota & Nabhitabhata 1991).

Substantial geographic variation has also been reported in another widespread *Gekko* species, *G. gecko* (Linnaeus, 1758). As currently recognized, the species as a whole is distributed from Nepal, India and Bang-

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ladesh east to Indonesia, with populations as far north as southern China and as far south as Timor (Smith 1935; Rösler 2005). A morphological comparison of *G. gecko* populations from across the species range supported the recognition of *G. gecko azhari* Mertens, 1955 as a western form occurring in Bangladesh and probably adjacent parts of India (Rösler 2001, 2005). Based on Mertens' (1955) restriction of the type locality to Java, Rösler (2005) considered the nominate form restricted to Indonesia, Sarawak and Sabah, Brunei and the Philippines, with mainland localities questionable. He also recognized two other forms of *G. gecko*, both currently subsumed under *G. g. gecko*. Form A, with a tendency to form cross bands, occurs in South China, Taiwan and northern Vietnam. Form B is similar in appearance to the nominate form and occurs in Nepal (and possibly parts of North India) eastwards to Indochina, with possible contact zones with the nominate form in Peninsular Malaysia and with Form A in parts of southern Vietnam (Rösler 2005).

In southern China, two forms of *G. gecko*, "red" and "black: have been identified on morphological grounds (Zhang *et al.* 1997; Chan *et al.* 2006). Liu *et al.* (2000), Zhang *et al.* (2006), and Qin *et al.* (2007) examined these forms with respect to divergence in mitochondrial genes, and drew differing conclusions regarding the taxonomic distinctness of the color morphs. Possible further evidence of multiple species in *G. gecko* comes from chromosomal studies. Although all individuals karyotyped had a diploid number of 38 and a fundamental number of 48 (Cohen *et al.* 1967; Wu & Zhao 1984; Solleder & Schmid 1984; Sharma & Kasid 1992; Du *et al.* 2002), Solleder & Schmid (1984) identified heteromorphic sex chromosomes in males, while these were not reported by other workers, and some workers reported acrocentric pairs (Cohen et al 1967), whereas others explicitly state that none are present (Sharma & Kasid 1992).

Nabhitabhata *et al.* ("2000" 2004) recognized five species of *Gekko* in Thailand, *G. gecko*, *G. siamensis*, *G. monarchus* Schlegel, 1836, *G. smithii*, and *G. petricolus* Taylor, 1962. All *Gekko gecko* from Thailand were regarded by Rösler (2005) to belong to his Form B, typically exhibiting the same bright (red or orange spots on a bluish background) coloration that is typical of tokay geckos from the type locality in Java. This is also the morph that has been figured by Taylor (1963; Chiang Mai Province), Manthey and Grossmann (1997; locality unspecified), Stanner *et al.* (1998; Phatumthani Province), Chan-ard *et al.* (1999; Nakhon Ratchasima Province, Chanthaburi Province, Si Sa Ket Province), and Grossmann (2004; Nakhon Ratchasima Province, Phang Nga Province, Satun Province). Based on published records (e.g., Taylor 1963; Rösler 2005), this form of tokay gecko is widespread throughout Thailand. We here report the discovery of a new species of the *G. gecko* group *sensu lato* from Kanchanaburi Province, western Thailand, that differs in several features from the common Thai tokay, with which it is sympatric.

Material and methods

Specimens were collected by hand and, after being kept alive in a terrarium for observation for approximately four months, were fixed in 95% ethalnol. All type specimens have been deposited in the Chulalongkorn University Museum of Zoology, Herpetological Section, Bangkok (CUMZ R) and the Institut Royal des Sciences Naturelles de Belgique, Brussels (IRSNB). 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 cor-

ner 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 a Nikon SMZ 1000 stereo dissecting microscope.

Comparisons were made with additional museum material in the collection of the Academy of Natural Sciences of Philadelphia (ANSP) and Museum für Naturkunde, Berlin (ZMB), as well as original published descriptions and descriptions provided in broader faunal and taxonomic treatments (e.g., Smith 1935; Taylor 1963; Brown & Alcala 1978; Zhou *et al.* 1982; Grossmann & Ulber 1990; Ota & Nabhitabhata 1991; Ota *et al.* 1991, 1995; Darevsky & Orlov 1994; Günther 1994; Szczerbak & Nekrasova 1994; Manthey & Grossmann 1997; Rösler 2005; Rösler *et al.* 2005, 2006; Brown *et al.*, 2008; Toda *et al.* 2008).

***Gekko nutaphandi* sp. nov.**
Figures 1–4

Holotype. CUMZ.R. 2003.123, adult female; Thailand, Kanchanaburi Province, Sai Yok District, Sai Yok Noi waterfall (14°25'N, 98°55'E); collected by Montri Sumontha, 26 August 2003.

Paratypes. IRSNB 2647, adult female, IRSNB 2648-2649, adult males; same locality and collector data as holotype.

Diagnosis. A medium-sized *Gekko*, snout-vent length at least 116 mm. Dorsum with 14 rows of prominent, large conical tubercles. Rostral approximately three times wider than deep, without rostral groove, excluded from contact with nostril rim. Precloacal pores (represented by a series of distinct pale scales in females) in a continuous series of 17–22, femoral pores absent. Digit IV of pes with 15 enlarged subdigital scansors. Dorsal pattern of bright white spots arranged in a series of eight transverse bands from nape to sacrum. Iris color in life deep brick red.

Gekko nutaphandi may be distinguished from *G. subpalmatus*, *G. melli*, *G. athymus* Brown & Alcala, 1962, *G. scientiadventura* Rösler *et al.*, 2005, *G. tawaensis* Okada, 1956 by the presence of dorsal tubercles; from *G. tawaensis* and two new species from the Ryukyus (Toda *et al.* 2008) by the presence of precloacal pores in males; from *G. japonicus* Schlegel, 1836, *G. swinhonis*, Günther, 1864, *G. hokouensis* Pope, 1928, *G. taibaiensis*, Song, 1985, *G. auriverrucosus* Zhou & Liu, 1982, *G. scabridus*, Liu & Zhou, 1982, *G. chinensis*, Gray, 1842, *G. yakuensis* Matsui & Okana, 1968, *G. liboensis*, Zhou & Li, 1982, *G. badenii*, Szczerbak & Nekrasova, 1994, and a new species from China (Zhou & Wang 2008) by larger size (to at least 116 mm SVL versus < 80 mm SVL); from *G. vittatus* Houttuyn, 1782, *G. porosus* Taylor, 1922, *G. gigante* Brown & Alcala, 1978, *G. kikuchii* Oshima, 1912, *G. mindorensis* Taylor, 1919, *G. monarchus*, *G. romblon* Brown & Alcala, 1978, *G. palawanensis* Taylor, 1925, *G. ernstkelleri* Rösler *et al.*, 2006, and a new species from the Philippines (Brown *et al.* 2008), by the lack of femoral pores; from *G. petricolus* and *G. ulikovskii*, Darevsky & Orlov, 1994 by its lack of a rostral groove (versus an X- or Y-shaped groove) and by a more robust body and distinctive pattern of transverse series of white spots (versus scattered pale or pale and dark spots or a greenish-yellow dorsum without spots, respectively); from *G. grossmanni*, Günther, 1994 by lack of nostril-rostral contact and by larger, keeled to mucronate dorsal tubercles.

Gekko nutaphandi is most similar to *G. gecko*, *G. smithii*, *G. siamensis*, *G. verreauxi*, and *G. albofasciolatus* Günther, 1872, which have previously been considered to be closely related based on their shared possession of a suite of features: adult SVL > 110 mm; scales on snout as large or slightly larger than those on dorsum of body; > 18 subdigital scansors under digit IV of pes; absence of femoral pores and a relatively low number of precloacal pores (<24) (Ota & Nabhitabhata 1991; Ota *et al.* 1991). From these species, *G. nutaphandi* differs in its lower number of subdigital scansors (15 under digit IV of pes). From *G. verreauxi* it differs in having a greater number of dorsal tubercle rows (14 versus 11), rostral excluded versus entering nos-

tril, and a regular pattern of transversely oriented light spots (versus dark spots and irregular blotches); from *G. smithii* in having more rows of dorsal tubercles (14 versus 8-13), rostral groove absent versus present, and eye color red versus green; from *G. albofasciolatus* in having more rows of dorsal tubercles (14 versus 10-11), rostral groove absent versus present (though variable in *G. albofasciolatus*), and eyes red versus green; and from *G. gecko* in having the rostral groove absent versus present, and eye color red versus pale golden, copper, or brown to olive (see Grossmann 2004 for color photographs). It bears the greatest resemblance to *G. siamensis* from which it differs in generally having fewer rows of dorsal tubercles (14 versus 14–19, but usually > 15), a much larger internasal scale, fewer ventral scales (30–31 versus 33–36), fewer supralabial scales (12–14 versus 17–21), and red versus green eyes in life. The 17–22 precloacal pores (or pitted scales in females) in *G. nutaphandi* exceed the ranges for *G. verreauxi* (13), *G. albofasciolatus* (14), *G. siamensis* (10–13), and *G. smithii* (7-16) and falls within the range of *G. gecko* (10-24). Although superficially similar to *G. siamensis*, *G. albofasciolatus*, and *G. smithii* in having a relatively drab body with transverse series of pale spots, it differs strongly from typical *G. gecko* in lacking a bluish-gray dorsum with widely distributed orange to red spots and a series of pale (whitish to gray or sky blue) spots arranged in transverse bands between the occiput and sacrum (but see Discussion for comparison of other "*G. gecko*" morphs). Selected features of taxa within this group of large-bodied *Gekko* are summarized in Table 1.

TABLE 1. Comparison of selected features among *Gekko nutaphandi*, **sp. nov.** and other members of the *Gekko gecko* group. Summary data for other species derived chiefly from Smith (1935), Grossmann & Ulber (1990), Ota & Nabhitabhata (1991), Ota *et al.* (1991), Manthey & Grossmann (1997), and Rösler (2005).

Species	max SVL (mm)	Dorsal tubercle rows	Subdigital lamellae (digit IV, pes)	Precloacal pores	Rostral enters nostril	Rostral groove	Eye color
G. nutaphandi	117	14	15	17–22	-	-	brick red
G. albofasciolatus	162	10–11	22–23	14	-	+/-	green
G. gecko	185	9–18	17–24	10–24	-	+	golden to copper or brown to olive
G. siamensis	150	14–19	11–16	10–13	-	-	green
G. smithii	191	8–13	23–26	7–17	-	+	green
G. verreauxi	130	11	21–22	13	+	-	?

Description (based on the holotype)**.** Adult female, SVL 92.2 mm (Figs. 1–2). Head long (HeadL/SVL ratio 0.30), relatively broad (HeadW/HeadL ratio 0.74), somewhat depressed (HeadH/HL ratio 0.41), strongly distinct from neck. Lores and interorbital region slightly inflated. Snout moderate (SnEye/HeadL ratio 0.42), less than twice eye diameter (OrbD/SnEye ratio 0.61); scales on snout and forehead small to moderate in size, granular and slightly domed to flattened; scales on snout much larger than those on interorbital region. Eye relatively large (OrbD/HeadL ratio 0.25); pupil vertical with crenulated margins; supraciliaries short, posteriormost bearing minute spines. Ear opening oval, vertically oriented, large (EarL/HeadL ratio 0.14); eye to ear distance only slightly greater than diameter of eyes (EyeEar/OrbD ratio 1.04). Rostral approximately 3 times wider (3.8 mm) than deep (1.2 mm), no rostral groove present; two much enlarged supranasals incompletely separated by a single, very large, oval internasal; rostral in contact with supralabial I and supranasals, internasal separated from rostral by narrow anterior contact of supranasals; nostrils oval, each surrounded by supranasal, first supralabial, two dorsally located postnasals and a large nasal, which enters the nostril forming a recessed valvular flange in its posterior third; 3 rows of scales separate orbit from supralabials. Mental triangular, somewhat deeper (3.0 mm) than wide (2.4 mm) and not much deeper than infralabials; one pair of greatly enlarged postmentals meeting at a point behind the mental, each postmental bordered anteriorly by

first infralabial, medially by mental, laterally by the first scale in a row of enlarged scales bordering the infralabials, and posteriorly by two small (3-4 times the size of a granular gular scale) chin shields, the medial one in shared contact with both left and right postmentals. Infralabials bordered by a row of enlarged scales, decreasing in size posteriorly. Enlarged supralabials to midpoint of orbit 10 (left and right); supralabials to angle of jaws 12 (right)–14 (left); enlarged infralabials 10 (left and right); interorbital scale rows across narrowest point of frontal 12, between supraciliaries 24. Supraorbital scales highly heterogeneous in size, largest at medial edge of orbit in midorbital position.

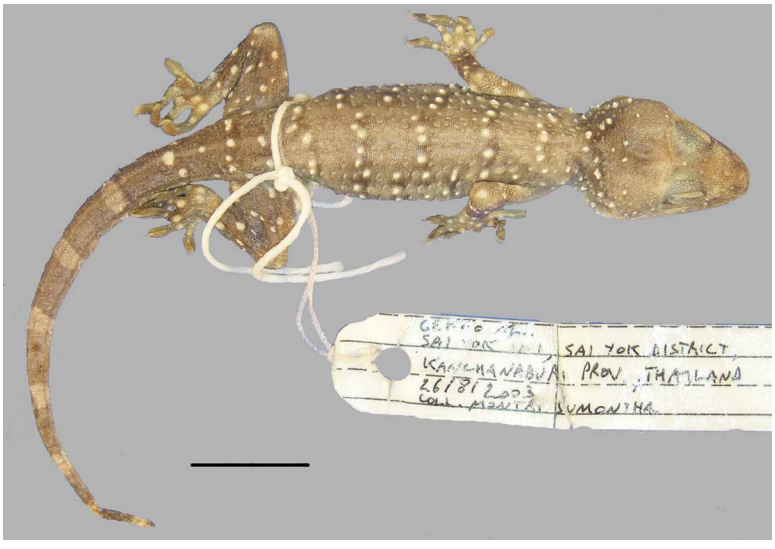

FIGURE 1. Dorsal view of the holotype (CMUZ.R.2003.123) of *Gekko nutaphandi* **sp. nov.** from Sai Yok Noi waterfall, Sai Yok District, Kanchanaburi Province, Thailand (14°25'N, 98°55'E). Scale bar = 20 mm.

FIGURE 2. Holotype of *Gekko nutaphandi* **sp. nov.** in life. Note the pale dorsal coloration. Photo by Montri Sumontha.

Body robust, trunk relatively long (TrunkL/SVL ratio 0.39), dorsoventrally depressed in cross-section, with small but distinct ventrolateral folds without denticulate margins. Dorsal scales heterogeneous, granular, rectangular to oval, flattened; regularly arranged, small (5-6 times size of granules), conical, posteriorly-directed tubercles extending from posterior margin of orbit to tail; tubercles much smaller on parietal region than elsewhere, larger on mid-flanks than middorsally or on ventral flanks; tubercles in 14 rows at midbody. Ventral scales smaller than dorsal tubercles, subimbricate; somewhat larger on abdomen than on chest, becoming granular and much smaller in gular region; midbody scale rows across belly to ventrolateral folds 31. Slightly enlarged precloacal scales in a single row of 22, pitted but without pores, in a pale, sharply con-

trasting row. Scales on palm and sole smooth, flat, rounded; scales on dorsal aspects of hind limbs heterogeneous – granular, intermixed with larger tubercules, some conical, others flattened with a small distal point at distal scale margin; scales on dorsal surface of forelimb proximal to elbow subimbricate, weakly heterogeneous, those distal to elbow granular intermixed with larger oval to triangular tubercles.

FIGURE 3. Adult specimen (not collected) of *Gekko nutaphandi* **sp. nov.** in life illustrating bolder dorsal coloration than the holotype and showing the brick red iris typical of this species. Photo by Piya Akkharavitoon.

FIGURE 4. Lateral view of head of *Gekko nutaphandi* **sp. nov.** illustrating the brick red eye color and large ear opening of this species. Photo by Bullung Siriphiphat.

Fore- and hindlimbs moderately long, stout; forearm and tibia moderately long (ForeaL/SVL ratio 0.15; CrusL/SVL ratio 0.19); digits relatively short, digit I, both manus and pes, clawless, all remaining digits

strongly clawed; digits of manus and pes feebly webbed at base; distal portions of digits strongly curved, arising from distal portion of expanded subdigital pad; scansors beneath each toe undivided; scansors from proximalmost at least twice diameter of palmar scales to distalmost: 12-12-14-15-13 (left manus), 11-[damaged]-13-15-13 (right manus), 12-14-14-15-14 (left pes), 12-12-14-14-13 (right pes). Relative length of digits of manus: IV > III > V > II > I; of pes: IV > III > V > II > I.

Tail depressed, slightly longer than head and body (TailL/SVL ratio 1.04); dorsal surface of tail covered with small, square to oval, juxtaposed to weakly subimbricate granules forming regular transverse rows, about 10 such rows per distinct caudal segment (corresponding to underlying muscle segments); ventral scales much larger (3 rows per caudal segment), smooth, imbricate, with a median pair of enlarged subcaudal plates extending about 2/3 across the width of tail. Posterior portion of dorsum of each tail segment with a single transverse row of 6 enlarged, rounded tubercles, each with upturned keeled or mucronate distal margin (ventrolateral pair of tubercles largest, not keeled or mucronate). Distal portion of tail present, but partly damaged. One small, rounded postcloacal spur on each side of tail base.

Coloration (in preservative). Body grayish brown with a series of 8 transverse rows of bright white spots, mostly corresponding to tubercles (one on nape, one across shoulders, 4 between axilla and groin, 2 across sacrum). Anterior margin of each row of white spots coincident with a slightly diffuse dark brown band 1-1.5 tubercles in width. One transverse row of white tubercles at level of first postpygal vertebra; postpygal tail with a series of 7 grayish bands, basally corresponding to every fourth caudal segment. Base color of hindlimbs and tail purplish brown, slightly darker than dorsum and forelimbs. Limbs patterned as dorsum with rows of white tubercles continuing on to joints of digits. Scattered white tubercles extending forward from ear (base of nuchal band) to posterior edge of orbit and across temporal region. Three bright white spots forming a triangle at the occiput, one small white spot in midorbital position, and scattered white spots on canthus, across nasals and at border of supralabials. Rostral and anterior supralabials paler than remainder of snout. Venter cream, each scale with diffuse, minute dark speckles, pigmentation heaviest under parts of throat and anterior margins of hindlimbs. Palms and soles slightly yellowish brown; distal portion of subdigital scansors densely covered with dark brown speckles. Tail venter more-or-less uniform grayish brown.

In life background color from grayish brown to chestnut brown (Figs. 2–3). Venter pearly grayish-white. Iris brick red (Fig. 4).

Variation. The paratypes, although not as well preserved as the holotype, are very similar in most respects (Table 2). The two male paratypes possess well-developed precloacal pores in 17 (IRSNB 2649) and 19 (IRSNB 2648) rows, and the female paratype, IRSNB 2647, has 19 pitted scales in corresponding position. The color in preservative of the paratypes is uniformly bolder than the holotype, with a dark, almost purplish-brown background, and transverse bands of bright white spots.

Etymology. The specific epithet is a patronym honoring the late Thai herpetologist Wirot Nutaphand (1932-2005) for his many technical and popular publications on reptiles and amphibians. He contributed remarkably to the popularity of reptiles and amphibians in Thailand, and to the respectability of studying them – stimulating the avocations and careers of many amateur and professional Thai herpetologists.

Distribution and Natural history. At present known only from a single limestone hill surrounded by bamboo forest. Specimens were located in the walls of shallow caves and on slender vegetation, particularly bamboo. The area has a diverse gecko fauna including *Dixonius siamensis* Boulenger, 1898, *D. hangseesom* Bauer *et al.*, 2004, *Hemidactylus frenatus*, *Gehyra mutilata* (Wiegmann, 1834), *G. fehlmanni* (Taylor, 1962), *G. lacerata* (Taylor, 1962), *Cyrtodactylus* cf. *peguensis* (Boulenger, 1893), and *C. tigroides* Bauer *et al.*, 2003. *Gekko gecko* occurs near the type locality in anthropogenic habitats, but the two congeners are not strictly syntopic. Other reptiles and amphibians at Sai Yok Noi are *Acanthosaura crucigera* Boulenger, 1885, *Calotes mystaceus* Duméril & Bibron, 1837, *C. emma* Gray, 1845, *Eutropis multifasciata* (Kuhl, 1820), *Sphenomorphus maculatus* (Blyth, 1853), *Ahaetulla prasina* (Boie, 1827), *A. nasuta* (Bonnaterre, 1790), *Dryocalamus davisonii* (Blandford, 1878), *Lycodon capucinus* Boie, 1827, *Lycodon subcinctus* Boie, 1827, *Pareas carina-*

tus (Boie, 1828), *Ophiophagus hannah* (Cantor, 1836), *Cryptelytrops albolabris* (Gray, 1842), *C. kanburiensis* (Smith, 1943), *Ingerophrynus macrotis* (Boulenger, 1888), *Microhyla ornata* (Duméril & Bibron, 1841), *M. heymonsii* Vogt, 1911, *Kaloula pulchra* Gray, 1831, *Calluella guttulata* (Blyth, 1855), *Fejervarya limnocharis* (Gravenhorst, 1829), *Polypedates leucomystax* (Gravenhorst, 1829) and *P. mutus* (Smith, 1940) (M. Sumontha, pers. obs.). Kitti's hog-nosed bat (*Craseonycteris thonglongyai*) and the Blue Whistling Thrush (*Myophonus caeruleus*) are among the characteristic endothermic vertebrates of the area.

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

	CUMZ.R.2003.123 Holotype	IRSNB 2647 Paratype	IRSNB 2648 Paratype	IRSNB 2649 Paratype
Sex	♀	♀	♂	♂
SVL	92.2	116.8	111.1	112.7
ForeaL	14.2	15.6	16.1	16.9
CrusL	17.5	20.7	21.1	19.3
TailL	95.7	14.6 (broken)	91.9 (regen.)	136.3
TailW	8.5	10.0	9.4	10.0
TrunkL	35.5	46.7	46.2	44.2
HeadL	27.7	33.2	32.5	32.9
HeadW	20.6	24.0	21.6	21.3
HeadH	11.4	14.1	14.3	11.5
OrbD	7.0	8.7	8.5	8.4
EyeEar	7.4	8.8	7.6	8.3
SnEye	11.5	14.3	13.9	14.1
NarEye	8.2	10.2	9.9	10.0
Interorb	10.3	11.8	11.1	10.7
EarL	3.9	6.5	5.9	6.0
Internar	3.5	3.9	4.0	3.5
Tubercle Rows	14	14	14	14
Ventral Scales	31	30	30	30
Precloacal pores	22 (pits)	19 (pits)	19	17

Discussion

It is clear that *G. nutaphandi* is distinct from the recognized species of *Gekko*, however, given that variation in *G. gecko* is extensive and only incompletely assessed (Mertens 1955; Grossmann 1987; 2004; Rösler 1995, 2005), it is necessary to rule out synonyms that might apply to this population. A number of names are currently in synonymy of *G. gecko* (Kluge 2001). Several of these (*G. verticillatus* Laurenti, 1768; *G. teres* Laurenti, 1768) are based, at least in part, on illustrations appearing in Seba (1734) that appear to be referable to typical *G. gecko*. Likewise, *G. verus* Merrem, 1820 and *G. indicus* Girard, 1857 are clearly attributable to the typical, brightly colored tokay. Rösler (2005) suggested that neither *G. perlatus* Houttuyn, 1782 nor *G. aculeatus* Houttuyn, 1782 were unambiguously assignable to *G. gecko*, or even to the genus *Gekko*. We agree with this assessment and, in the absence of extant type material or illustrations of such, we consider any allocation of these names to the synonymy of recognized species as tentative at best. Certainly there is nothing that

would suggest synonymy with *G. nutaphandi*. *Gekko annulatus* (Kuhl, 1820) was questionably synonymized with *G. gecko* by Wermuth (1965), and Rösler (2005) considered this identification likely. We, however, consider the description to be too uninformative to be definitive. *Gekko guttatus* (Daudin, 1802) appears to be a composite of several taxa. One of these is certainly the typical form of *G. g. gecko*, but the others are not unambiguously identifiable, and Daudin's original material is no longer extant (Brygoo 1990).

Among the morpho-groups of *Gekko gecko* identified by Rösler (2005) *G. nutaphandi* is superficially most similar to Form A, which is characterized by distinct pale bands on a more or less dark background. This would appear to correspond to the "black" or "dark form" tokays of China (e.g., Chan *et al.* 2006). However, Rösler (2005) regarded this form as limited in distribution to southern China and northern Vietnam, whereas all of Thailand was characterized by having Form B, which resembles the typical red or orange-spotted tokay. Both Vietnamese (Grossmann 2004, figs. pp. 11–12; Rösler 2005, fig. 8) and Chinese (Chan *et al.* 2006, fig. 1; but see Rösler 2005, fig. 7) "black" tokays, however, exhibit extensive patterning on the dorsum of the head (versus few, scattered, small white spots in *G. nutaphandi*) and have higher lamellar counts (e.g., 18–24 versus 15 under digit IV of pes; Rösler 2005). These darker tokays may be referable to *Gekko reevesii* (Gray, 1831); the status of this name is under investigation by Rösler (see Rösler *et al.* 2005).

The discovery of *Gekko nutaphandi* in association with karstic landscape features highlights the significance of limestone habitats for gecko biodiversity in Southeast Asia. The recently described *Gekko scientiadventura* was also discovered on and around karst limestone outcrops in Vietnam (Rösler *et al.* 2005) as have been a diversity of recently discovered Southeast Asian geckos in the genus *Cyrtodactylus* (Bauer *et al.* 2002, 2003; Ziegler *et al.* 2002; Nguyen *et al.* 2006; Heidrich *et al.* 2007). The type locality of *Gekko nutaphandi* is also the type locality of the recently described *Dixonius hangseesom* (Bauer *et al.* 2004). Further surveys are required to determine the total distributional range of *G. nutaphandi* relative to its probable sister taxon, *G. siamensis*, which until now has been recorded only from central Thailand (Grossmann & Ulber 1990; Ota & Nabhitabhata 1991).

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