



## A new Four-clawed Gecko from limestone hills in Lopburi Province, central Thailand (Squamata, Gekkonidae: *Gehyra*)

OLIVIER S. G. PAUWELS<sup>1,\*</sup>, WORAWITOO MEESOOK<sup>2</sup>, KIRATI KUNYA<sup>3</sup>,  
NATTASUDA DONBUNDIT<sup>4</sup> & MONTRI SUMONTHA<sup>5</sup>

<sup>1</sup>Royal Belgian Institute of Natural Sciences, Rue Vautier 29, B-1000 Brussels, Belgium.

✉ [opauwels@naturalsciences.be](mailto:opauwels@naturalsciences.be), ✉ [osgpauwels@yahoo.fr](mailto:osgpauwels@yahoo.fr); <https://orcid.org/0000-0002-3265-5496>

<sup>2</sup>Faculty of Science and Technology, Rajamangala University of Technology Srivijaya, 109 M. 2, Tham Yai Subdistrict, Thung Song District, Nakhon Si Thammarat Province 80110, Thailand.

✉ [worawitoo.m@rmutsv.ac.th](mailto:worawitoo.m@rmutsv.ac.th); <https://orcid.org/0000-0001-6781-3645>

<sup>3</sup>Nakhonratchasima Zoo, 111 M. 1, Ratchasima-Pak Tongchai Rd., Chaimongkol, Muang, Nakhon Ratchasima 30000, Thailand.

✉ [kkunya2006@gmail.com](mailto:kkunya2006@gmail.com); <https://orcid.org/0000-0002-7219-6239>

<sup>4</sup>Department of Biology, Faculty of Science, Khon Kaen University, Muang, Khon Kaen 40002, Thailand.

<https://orcid.org/0000-0002-3074-9288>

<sup>5</sup>Ranong Marine Fisheries Research and Development Station, 157 Chaloe Phrakiat Rd., Paknam, Muang, Ranong 85000, Thailand.

✉ [montri.sumontha@gmail.com](mailto:montri.sumontha@gmail.com); <https://orcid.org/0000-0003-4829-7731>

\*Corresponding author

### Abstract

We describe *Gehyra wongchan* sp. nov. from Tham Khao Chan (Khao Chan Cave), Tha Luang District, and Wat Khao Wong, Kok Samrong District, in Lopburi Province, central Thailand. The new species differs from all currently recognized *Gehyra* by the following combination of morphological characters and dorsal color pattern: maximal known snout–vent length of 52.4 mm, 8–10 supralabials, 76–80 dorsal and 48–50 ventral scale rows around midbody, absence of skin folds on limbs, 17 or 18 preanofemoral pores in males in a continuous series extending to mid-length of femur (pores absent in females), tail not- to moderately widened behind vent in adults, a single row of widened subcaudals, digits and toes unwebbed, 7 or 8 divided subdigital lamellae on 4th toe, and a dorsal pattern with white spots as large or larger than adjacent crescentic black markings on a beige to light-brown background.

**Key words:** *Gehyra wongchan* sp. nov., taxonomy, morphology, karst, cave, Saraburi Group Limestones

### Introduction

The genus *Gehyra* Gray currently includes 67 recognized species, most of which occur in Melanesia or Australia (Uetz *et al.* 2021). One of these species, *Gehyra mutilata* (Wiegmann, 1834), originally described from the Philippines, has been introduced into many tropical and subtropical areas throughout the World. The northwestern part of the natural range of the genus *Gehyra*, *i.e.*, China, Thailand and the Indochinese Region (Cambodia, Laos, Myanmar, Vietnam), is inhabited by only four species: *G. angusticaudata* (Taylor, 1963), *G. fehlmanni* (Taylor, 1962), *G. lacerata* (Taylor, 1962) and *G. mutilata*. *Gehyra angusticaudata* is endemic to Thailand, and still known only through its types (Meiri *et al.* 2017). The conspecificity between the Thai and the Vietnamese populations of *Gehyra fehlmanni* and between the Thai and Vietnamese populations of *G. lacerata* (Grismer *et al.* 2007; Bobrov & Semenov 2008) has never been assessed and requires confirmation. Among the Thai gekkonid genera, *Gehyra* has been the most neglected by herpetologists, with no species described in nearly six decades. The lack of attention to these moderately-sized, dull-colored geckos is probably due more to their poor popularity among zoologists and reptile hobbyists than to an actual low diversity.

At the time our field team discovered *Gekko (Gekko) pradapdao* Meesook, Sumontha, Donbundit & Pauwels in Khao Chan cave in Lopburi Province, central Thailand, we noticed that among the syntopic gecko species there was a distinctly patterned *Gehyra* that we then provisionally identified as *Gehyra* cf. *angusticaudata* (Meesook *et*

al. 2021). After examination, we conclude that this population markedly differs in pattern and scalation from all currently recognized Southeast Asian *Gehyra* species, and consequently describe it herein as new.

## Material and methods

Voucher specimens were fixed in 90% ethanol and subsequently transferred into 70% ethanol for permanent storage in the herpetological reference collection of the Chulalongkorn University Museum of Zoology, Bangkok. Paired meristic characters are given left/right. Numbers of supralabial and infralabial scales were counted from the largest scale immediately posterior to the dorsal inflection of the posterior portion of the upper jaw to the rostral and mental scales, respectively. The number of longitudinal rows of ventral scales was counted transversely across the center of the abdomen. The sex of the types was determined based on the presence or absence of precloacal pores and hemipenial swellings.

The following measurements were taken with a digital caliper to the nearest 0.1 mm: DigitL I-V: length of digits one to five; EarL: ear length, the greatest horizontal distance of the ear opening; FAL: forearm length, taken on the dorsal surface from the posterior margin of the elbow while flexed 90° to the inflection of the flexed wrist; HeadD: head depth, the maximum depth of head from the occiput to the throat; HeadL: head length, from the posterior margin of the retroarticular process of the lower jaw to the tip of the snout; HeadW: head width, measured at the angle of the jaws; InterN: internarial distance, measured between the nares across the rostrum; InterOrb: interorbital distance, measured between the anterior edges of the orbits; MenL: length of the mental; MenW: width of the mental; NeckW: maximum width of neck; NosOrb: nostril to orbit distance, from the posterior margin of the external nares to the anterior margin of the orbit; OrbD: orbit diameter, the greatest horizontal diameter of the orbit; OrbEar: orbit to ear distance, from the anterior edge of the ear opening to the posterior edge of the orbit; RosH: height of the rostral; RosW: maximum width of the rostral; SnOrb: snout to eye distance, from the tip of the snout to the anteriormost margin of the orbit; SVL: snout-vent length, taken from the tip of snout to the vent; TailL: tail length, taken from the vent to the tip of the tail, original or regenerated; TailW: tail width, taken at the base of the tail immediately posterior to the postcloacal swelling; TibL: tibia length, taken on the ventral surface from the posterior surface of the knee while flexed 90° to the base of heel; ToeL I-V: length of toes one to five; TrunkL: axilla to groin length (trunk length), taken from the posterior margin of the forelimb at its insertion point on the body to the anterior margin of the hind limb at its insertion point on the body. Meristic characters abbreviations: DSR: number of dorsal scale rows at midbody; IL: infralabial scales; InterOrbS: interorbital scales counted across the narrowest point of the frontal bone; PrePo: preanofemoral pores; SL: supralabial scales; SLMOrb: number of supralabial scales at mid-orbital position; SubDL: number of subdigital lamellae; SubDLT4: number of subdigital lamellae beneath 4<sup>th</sup> toe; VentR: number of longitudinal ventral scale rows at midbody, between the ventrolateral body folds.

Comparisons were made using original descriptions and revisions of all currently recognized Southeast Asian *Gehyra* species, as well as other publications containing pertinent or original data, including photographs illustrating the variability of coloration patterns (Flower 1899; Boulenger 1900; Smith 1935; Taylor 1962, 1963; Lue *et al.* 1987; Beckon 1992; Zhao & Adler 1993; Manthey & Grossmann 1997; Karsen *et al.* 1998; Chan-ard *et al.* 1999, 2015; Nabhitabhata *et al.* 2004; Grismer *et al.* 2007; Bobrov & Semenov 2008; Bourret 2009; Oliver *et al.* 2010, 2016; Teynié & David 2010; Grismer 2011; Rösler & Scheidt 2013; Goldberg & Grismer 2016; Vassilieva *et al.* 2016; Tanalgo & Hughes 2017; and references therein) and museum preserved specimens (see Appendix). Although we did not have specimens in hand, the herpetological team of the Field Museum of Natural History kindly sent us detailed photographs of the holotype and of a paratype of *Gehyra angusticaudata*, and of the holotype and the single paratype of *G. fehlmanni*. Interspecific comparisons provided in Table 2 are based on the latter photographs, the above cited literature, and the physical examination of the specimens listed in the Appendix.

Museum and other acronyms: CUMZ-R: Chulalongkorn University Museum of Zoology, Reptile Collection, Bangkok; FMNH: Field Museum of Natural History, Chicago; MNHN: Muséum national d'Histoire naturelle, Paris; MS: Montri Sumontha's field number series; RBINS: Royal Belgian Institute of Natural Sciences, Brussels; RFD: Royal Forest Department, Bangkok, Thailand; and THNHM: Thailand Natural History Museum, National Science Museum, Technopolis, Pathum Thani. Other abbreviations: Dist. = District; Prov. = Province.

## Systematics

### *Gehyra wongchan* sp. nov.

(Figures 1–6)

*Gehyra* cf. *angusticaudata*—Meesook *et al.* 2021: 322.

Holotype. CUMZ-R-2598 (field no. MS 740), adult male caught on 20 October 2020 in Tham (= Cave) Khao Chan (14°58'35.2"N, 101°18'11.2"E), Tha Luang District, Lopburi Province, central Thailand, by W. Meesook, N. Donbudit and M. Sumontha.

Paratypes (4). CUMZ-R-2599 and CUMZ-R-2613 (field nos. MS 261 and MS 262, respectively), adult male and juvenile female collected on 26 April 2008 at Wat Khao Wong (ca. 14°57'51.5"N 100°41'58.3"E), Kok Samrong District, Lopburi Province, by K. Kunya and M. Sumontha. CUMZ-R-2611 and CUMZ-R-2612 (field nos. MS 738 and MS 739, respectively), juvenile male and adult female collected on 26 March 2021; same locality and collectors as holotype.

**Diagnosis.** *Gehyra wongchan* sp. nov. can be distinguished from all other congeneric species by the combination of its maximal known SVL of 52.4 mm, 8–10 supralabials, 76–80 dorsal and 48–50 ventral scale rows around midbody, absence of skin folds on limbs, 17 or 18 preanofemoral pores in males in a continuous series extending to mid-length of femur (pores absent in females), tail not- to moderately widened behind vent in adults, a single row of widened subcaudals (about 1/3 of the width of tail in its anterior part, progressively occupying the whole width of the tail towards the tip), digits and toes unwebbed, 7 or 8 divided subdigital lamellae on 4th toe, and a dorsal pattern with white spots as large or larger than adjacent crescent-shaped black markings on a beige to light brown background.

**Description of holotype.** Adult male (Figures 1–3 and Table 1). SVL 45.2 mm. Head long (HeadL/SVL 0.32), relatively broad (HeadW/HeadL ratio 0.63), somewhat depressed (HeadD/HeadL ratio 0.34), poorly distinct from neck.

Lores and interorbital region slightly inflated; prefrontal region concave; canthus rostralis smoothly rounded. Snout moderate (SnOrb/HeadL ratio 0.33), less than 1.5 times eye diameter (OrbD/SnOrb ratio 0.75); scales on rostrum, lores, top of head and occiput small, granular, lacking enlarged tubercles; scales on snout much larger than those on interorbital region. Eye relatively large (OrbD/HeadL ratio 0.25). Pupil vertical with crenelated margins. Supraciliaries short. Ear opening oval, moderate (EarL/HeadL ratio 0.08); eye to ear distance slightly shorter than diameter of orbit (OrbEar/OrbD ratio 0.89). Rostral more than two times wider (2.7 mm) than deep (1.2 mm). No rostral groove present; two much enlarged supranasals separated by two small, antero-posteriorly aligned, granular scales. Rostral in contact with supralabial I, nostrils, supranasals and a granular scale separating the supranasals. Nostrils oval, each surrounded by rostral, supranasal, two postnasals and first supralabial. Interorbital scale rows across narrowest point of frontal 13. Mental triangular, wider (2.6 mm) than deep (1.8 mm), much deeper than infralabials; mental in contact with four scales: laterally with first infralabials and posteriorly with a pair of greatly enlarged and elongate inner postmentals meeting behind the mental. Each postmental bordered anteriorly by first infralabial, medially by mental, laterally by an enlarged chin shield (outer postmental), and posteriorly by undifferentiated granular gular scales. Including the two postmentals, there are two pairs of enlarged chin shields. Enlarged supralabials to midpoint of orbit 8 (left and right); supralabials to angle of jaws 10 (left and right); enlarged infralabials 10 (left and right). Gular scales small, subimbricate, grading posteriorly into slightly larger, subimbricate pectoral scales, which grade posteriorly into larger, subimbricate ventrals.

Body robust, trunk relatively long (TrunkL/SVL ratio 0.63), dorsoventrally depressed in cross-section, with poorly distinct ventrolateral folds. Dorsal scales small, granular to subimbricate, without tubercles. Ventral scales slightly larger than dorsals. Midbody scale rows across belly to ventrolateral folds 48. No enlarged, precloacal scales. Seventeen pore-bearing precloacal scales, in a continuous row, extending to mid-length of the femur.

Scales on palm and sole smooth, flat, rounded. Scales on dorsal aspects of hind limbs homogeneous, granular. Scales on dorsal surface of forelimb homogeneous, granular, flat to slightly conical. Fore- and hind limbs moderately long, stout; forearm and tibia moderately long (FAL/SVL ratio 0.13; TibL/SVL 0.17). No skin folds (*sensu* Oliver *et al.* 2016) on fore and hindlimbs. Digits relatively short; digit I, both manus and pes, clawless; all remaining digits strongly clawed; distal portions of digits II–V strongly curved, arising from distal portion of expanded subdigital pad. Scansors beneath each toe divided; scansors 5-6-6-7-7 (left manus), 6-7-7-6-6 (right manus), 6-7-7-8-8 (left pes), 6-7-8-8-7 (right pes). Relative length of digits of manus: IV>V=III>II>I. No webbing between digits or toes.

Tail original, depressed, slightly longer than head and body (TailL/SVL ratio 1.10); dorsal surface of tail covered with small, squarish, juxtaposed granules forming more or less regular transverse rows. Median row of strongly enlarged subcaudal plates extending about 1/3 across the width of tail in its anterior part, progressively occupying the whole width of the tail towards the tip (Figure 2). A single, moderate, post-cloacal tubercle on each side of tail base.

**TABLE 1.** Meristic and morphometric (in mm) data for the type series of *Gehyra wongchan* **sp. nov.** Paired meristic characters are given left/right. NA = not assessed. Abbreviations defined in the text.

	Holotype, CUMZ-R-2598	Paratype, CUMZ-R-2599	Paratype, CUMZ-R-2611	Paratype, CUMZ-R-2612	Paratype, CUMZ-R-2613
Sex	Male	Male	Juv. male	Female	Female
SVL	45.2	52.4	36.0	47.1	40.8
TrunkL	28.7	32.2	22.2	29.0	25.9
TailL	49.6	56.9	39.3	41.1	39.1
(all original)					
TailW	7.2	6.0	2.3	5.3	4.6
HeadL	14.5	15.0	11.1	14.0	12.2
HeadW	9.1	10.8	7.4	9.1	8.7
HeadD	5.0	6.5	4.0	3.2	4.5
RosW	2.7	3.3	2.0	3.1	2.2
RosH	1.2	1.2	1.0	1.2	1.1
MenW	2.6	2.6	1.4	2.2	1.4
MenL	1.8	2.0	1.1	1.1	1.0
InterN	1.9	2.2	1.3	1.9	1.3
SnOrb	4.8	6.6	4.5	4.7	4.9
NosOrb	3.4	4.7	2.7	3.1	3.2
OrbD	3.6	4.2	2.7	3.5	3.3
InterOrb	1.8	2.2	1.5	1.7	1.6
OrbEar	3.2	3.8	2.8	3.1	3.1
EarL	1.2	1.4	0.9	0.9	0.8
NeckW	7.2	7.7	4.6	6.2	5.5
FAL	6.1	6.3	5.4	6.1	5.5
TibL	7.6	7.3	6.0	6.8	5.3
SL	10/10	9/8	10/10	8/8	9/9
SLMOrb	8/8	8/7	8/8	8/8	8/8
IL	10/10	6/6	9/8	7/8	8/8
InterOrbS	13	14	13	13	12
DigitL I-V (right)	2.3-2.7-3.0-3.2- 3.0	2.8-3.0-3.2-3.3-3.3	NA	2.2-2.4-3.0-3.1-2.6	NA
ToeL I-V (right)	2.7-3.5-3.9-4.4- 4.0	3.2-3.5-4.1-4.4-4.0	NA	2.7-3.0-3.2-3.5-3.2	NA
SubDL hand	5-6-6-7-7 / 6-7- 7-6-6	5-6-6-6-6 / 5-6- 6-6-6	5-6-7-7-7 / 5-6- 7-7-7	6-7-7-6-6 / 6-7- 7-6-6	6-7-7-7-7 / 6-7- 7-7-7
SubDL pes	6-7-7-8-8 / 6-7- 8-8-7	5-7-8-8-7 / 5-6- 7-7-6	6-7-7-8-8 / 7-7- 8-8-8	5-7-7-7-6 / 5-6- 7-7-6	5-7-8-7-7 / 6-7- 8-8-7
DSR	78	76	78	78	80
VentR	48	48	48	50	48
PrePo	17	18	17	0	0



**FIGURE 1.** Live adult male holotype (CUMZ-R-2598) of *Gehyra wongchan* **sp. nov.** *in situ* before capture. Photograph by M. Sumontha.



**FIGURE 2.** General ventral (top) and dorsal (bottom) views of the preserved adult male holotype of *Gehyra wongchan* **sp. nov.** Photographs by M. Sumontha.



FIGURE 3. Right view of the head of the preserved holotype of *Gehyra wongchan* sp. nov. Photograph by M. Sumontha.

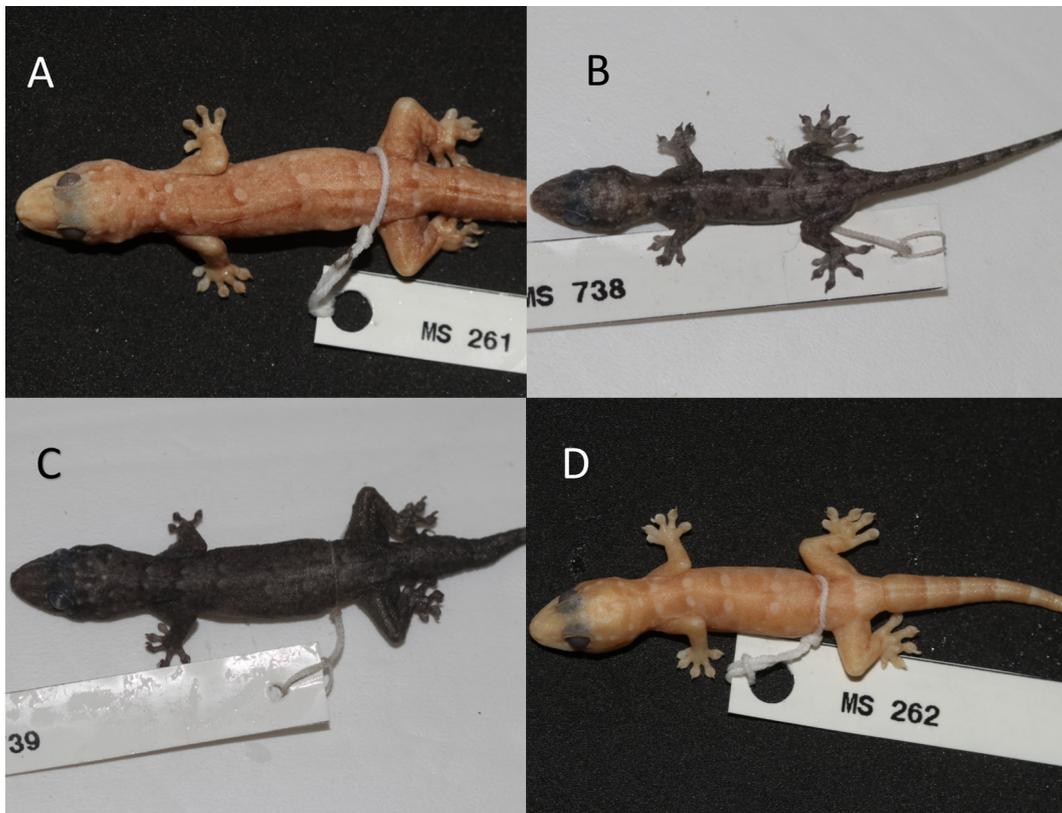


FIGURE 4. Dorsal views of the preserved paratypes of *Gehyra wongchan* sp. nov.: CUMZ-R-2599 (A), CUMZ-R-2611 (B), CUMZ-R-2612 (C) and CUMZ-R-2613 (D). Not to scale. Photographs by M. Sumontha.



**FIGURE 5.** Cloacal area of the adult male paratype CUMZ-R-2599 (top) and of the adult female paratype CUMZ-R-2612 (bottom) of *Gehyra wongchan* **sp. nov.** Note the continuous pore series extending to mid-length of the femur in the male, and the absence of pores in the female. Photographs by M. Sumontha.

**Coloration in life.** Background color of dorsal surface of head, dorsum, and dorsal surfaces of members and tail beige (Figure 1). Poorly contrasted and incomplete preorbital darkish stripe. Supraorbital region bluish. A few irregular black and white spots on the dorsal surface of head. Discontinuous black nuchal collar from one orbit to the other, posteriorly bordered on nape by four white spots. A pair of large white paravertebral spots on neck each anteriorly bordered by a black crescent, each white spot of a diameter of about seven dorsal granular scales. Five similar pairs of large white paravertebral spots between limb insertions, not symmetrically arranged. A few white small spots on lower flanks. A black crescent above sacrum. Dorsal surface of tail showing eight blackish bands, each bordered posteriorly by a whitish thinner band. No bands or spots on the dorsal surfaces of limbs, hands and feet. Throat and belly beige without spots, darkening towards posterior abdomen; pore-bearing scales lighter. Lower surface of limbs, hands, feet and tail brown. In preservative the general color darkens, and the dorsal pattern becomes less contrasting (Figures 2 and 3).

**Variation.** Main morphometric and meristic characters of the type series are provided in Table 1. Morphological characters and color pattern of the paratypes agree in most respects with the holotype. The females lack preanofemoral pores. As with the holotype, all paratypes have an original tail. Females show slightly shorter original tails than males (TailL/SVL ratio 0.87–0.96 vs. 1.09–1.10). The white spots on dorsum are proportionally smaller in juveniles than in adults (Figures 1, 2, 4 and 6).



**FIGURE 6.** Live adult *Gehyra wongchan* **sp. nov.** *in situ* in Khao Chan Cave, Lopburi Province, central Thailand. Individual not collected. Photograph by N. Anurakpongsathorn.

**Distribution and natural history.** Wat Khao Wong is located about 65 km W of Tham Khao Chan (Figure 14). Both sites lie on limestone hills surrounded by cultivated areas. These hills belong to the “Saraburi Group Limestones” in the south-west margin of the Khorat Plateau (Ponta *et al.* 2013; Warren *et al.* 2014). Nothing is known about the diet or the reproduction of the new species. The holotype was found while it was foraging on a tree near the entrance of Khao Chan Cave (Figures 1 and 15). At the type-locality, individuals were observed inside the cave, on limestone and trees near the cave entrance, and on nearby buildings. The species is locally common. Within Khao Chan Cave *Gehyra wongchan* **sp. nov.** individuals were observed in syntopy with *Dixonius siamensis* Boulenger, *Gekko pradapdao* and the ubiquitous *G. gecko* (Linnaeus), *Hemidactylus frenatus* Duméril & Bibron and *H. platyurus* (Schneider) (Gekkonidae). We found several individuals of *Lycodon capucinus* (Boie) in and around the cave, and numerous shed skins of *L. davisonii* (Blanford) (Colubridae) within the cave.

**Etymology.** The specific epithet *wongchan* is a name in apposition, invariable, based on the contraction of the localities of the paratypes (Wat Khao *Wong*) and of the holotype (Tham Khao *Chan*). In Thai *wongchan* also means the Moon, in reference to the typical crescent-shaped marks on the nape and dorsum of the new species. We suggest the following common names: จิ้งจกหินวงจันทร์ (*Djing-djok-hin wongchan*; Thai); Lunulate four-clawed gecko (English), and *Gehyra lunulée* (French).

**Comparison to other species.** Based on its scalation and dorsal pattern, *Gehyra wongchan* **sp. nov.** is readily distinguished from the four other *Gehyra* species found in mainland Southeast Asia; their main diagnostic characters are compared in Table 2.

**TABLE 2.** Comparison of selected diagnostic characters of all mainland Southeast Asian *Gehyra* spp. NA = not available. Bolded values are diagnostic differences from *Gehyra wongchan* sp. nov. Abbreviations defined in the text.

Character/Species	<i>Gehyra angusticaudata</i>	<i>Gehyra fehlmanni</i>	<i>Gehyra lacerata</i>	<i>Gehyra mutilata</i>	<i>Gehyra wongchan</i> sp. nov.
Max. SVL	57	51	55	<b>61</b>	52.4
SL	10	8	<b>12</b>	8–11	8–10
IL	8 or 9	7–10	10 or 11	6–9	6–10
DSR	NA	NA	NA	NA	76–80
VentR	<b>35</b>	<b>42</b>	48	<b>35–44</b>	48–50
PrePo (males)	<b>31–37</b>	<b>22</b>	<b>20</b>	<b>24–44</b>	17 or 18
Webbing on hands and feet	<b>Basal</b>	<b>Basal</b>	Absent	<b>Basal</b>	Absent
SubDLT4	NA	NA	NA	6–8	7 or 8
Subcaudals widened	Yes	Yes	<b>No</b>	Yes	Yes
Tail widened behind vent (adults)	No to moderately	No to moderately	<b>Strongly</b>	<b>Moderately to strongly</b>	No to moderately
Spots on dorsum (adult pattern)	<b>White spots small and nearly indistinct; small black spots</b>	<b>White spots always present, smaller than the (transversally elongate) black spots</b>	<b>White spots always present, as large or larger than the (rounded) black spots</b>	<b>White spots often poorly to not visible; when present small or not larger than black spots</b>	White spots always present, as large or larger than the (crescent-shaped, adjacent) black spots

*Gehyra wongchan* sp. nov. differs from the Thai endemic *G. angusticaudata* by its much higher VentR (48–50 vs. 35), much lower PrePo number (17 or 18 extending to mid-length of the femur vs. 31–37 extending the whole length of the femur), absence of webbing on fingers and toes (vs. basal webbing), and its dorsal pattern (large white spots adjacent to black crescents vs. small and nearly indistinct white spots among small black spots, see Figures 7 and 8).

The holotype of *Gehyra fehlmanni* (Figure 9) was collected at “4 km. NW [of] Kanchanaburi, Kanchanaburi Province”, western Thailand. In the original description, Taylor (1962: 223) noted that the scales on dorsal and lateral surfaces of the holotype were irregular, “suggesting the possibility that the entire tail has been regenerated”, but also that the subcaudal scales are widened, “appearing to be normal and not reproduced”. The latter fact, combined with the presence on the dorsal surface of the tail of a color pattern pursuing the one seen on the dorsum, and of a lateral fringe of small denticulate scales, seems to indicate that the tail is original. Figure 10 is the first published image of the single paratype of *Gehyra fehlmanni*, collected at “Tonka Harbour Tin Mine, Ronpibon, Nakhon Si Thammarat Province”, southern peninsular Thailand, *i.e.*, at approximately 500 airline km south of the type-locality. Its tail has been lost and was not available to Edward Taylor for the species’ description.

*Gehyra wongchan* sp. nov. can be distinguished from *G. fehlmanni* by its higher VentR (48–50 vs. 42), lower PrePo number (17 or 18 vs. 22), absence of webbing on fingers and toes (vs. basal webbing), and by its dorsal pattern (transversally elongate black spots with smaller white spots in *G. fehlmanni*, see Figures 9–11). If the tail of the holotype of *Gehyra fehlmanni* is indeed original, it is shorter than the tails of males of *G. wongchan* sp. nov. (TailL/SVL ratio 0.89 vs. 1.09–1.10). A population of *Gehyra* cf. *fehlmanni* has been reported by Grismer *et al.* (2007) from eastern Cardamom Mountains in Cambodia, exhibiting a dorsal color pattern similar to that of *G. fehlmanni* but differing in several scalation characters. This Cambodian population differs from *Gehyra wongchan* sp. nov. by its dorsal pattern (in particular by its transversally elongate black spots, much larger than its white spots) and its 37 PrePo (vs. 17 or 18).



**FIGURE 7.** General dorsal (top) and ventral (bottom) views of the preserved adult male holotype of *Gehyra angusticaudata* (FMNH 178203; field nr 1035) from Chonburi Province, southeastern Thailand. Tail original. Photographs by J. Mata (FMNH).

*Gehyra wongchan* **sp. nov.** can be differentiated from *G. lacerata* by its lower SL number (8–10 vs. 12), lower PrePo number (17 or 18 vs. 20), its transversely enlarged subcaudals (vs. not enlarged), a tail not- to moderately widened posterior to vent (vs. strongly widened), and by its dorsal pattern (large white spots adjacent to black cres-

cents vs. large white spots, as large or larger than non-adjacent rounded black spots in *G. lacerata*). Adult *Gehyra lacerata* individuals have a much more robust habitus than adults of *G. wongchan* **sp. nov.** and of the other Thai representatives of the genus (Figure 12).



**FIGURE 8.** General dorsal (top) and ventral (bottom) views of a preserved adult female paratype of *Gehyra angusticaudata* (FMNH 178204; field nr 1034) from Chonburi Province, southeastern Thailand. Tail original. Photographs by J. Mata (FMNH).



**FIGURE 9.** General dorsal (top) and ventral (bottom) views of the preserved adult male holotype of *Gehyra fehlmanni* (FMNH 178207) from Kanchanaburi Province, western Thailand. Photographs by J. Mata (FMNH).



**FIGURE 10.** General dorsal (top) and ventral (bottom) views of the preserved adult female paratype of *Gehyra fehlmanni* (FMNH 178237) from Nakhon Si Thammarat Province, southern Thailand. Tail lost. Photographs by J. Mata (FMNH).



**FIGURE 11.** Live adult *Gehyra* cf. *fehlmanni* from Sai Yok District, Kanchanaburi Province, western Thailand. Photograph by M. Sumontha.

From *Gehyra mutilata* (and its Malayan subjective synonyms *Gehyra butleri* Boulenger, 1900, described from Kuala Lumpur, and *Peropus packardii* Cope, 1869, described from Penang; see synonymies by Taylor 1963 and Grismer 2011), *Gehyra wongchan* **sp. nov.** can be distinguished based on its smaller SVL (52.4 vs. 61 mm), higher VentR (48–50 vs. 35–44), lower PrePo number (17 or 18 vs. 24–44), absence of webbing on fingers and toes (vs. basal webbing), its dorsal pattern (large white spots adjacent to black crescents vs. white spots often poorly to not visible in *G. mutilata*, when present small or not larger than black spots), and a tail not- to moderately widened behind vent (vs. moderately to strongly widened) (Figure 13).

## Discussion

*Gehyra wongchan* **sp. nov.** brings the number of *Gehyra* taxa endemic to mainland Southeast Asia to four. These species are all found in syntopy or in close proximity with the widespread and anthropophilic *Gehyra mutilata*. We are currently studying the taxonomic status of three additional populations of *Gehyra* that probably represent additional new species from central and peninsular Thailand. We expect a much higher diversity in the genus *Gehyra* in the Indochinese Peninsula and the Thai-Malay Peninsula, and possibly a high level of endemism within karstic landscapes, as shown by other gecko genera such as *Cnemaspis* Strauch, *Cyrtodactylus* Gray and *Dixonius* Bauer, Good & Branch (Grismer *et al.* 2014, 2021; Pauwels *et al.* 2021).

*Gehyra wongchan* **sp. nov.** is not recorded from any protected area. The two sites where the species is known are separated by a straight line distance of 65 kilometers. They are also separated by the Pasak Chonlasit Dam, the largest freshwater reservoir of Central Thailand, whose filling was initiated in 1998. It is probable that populations

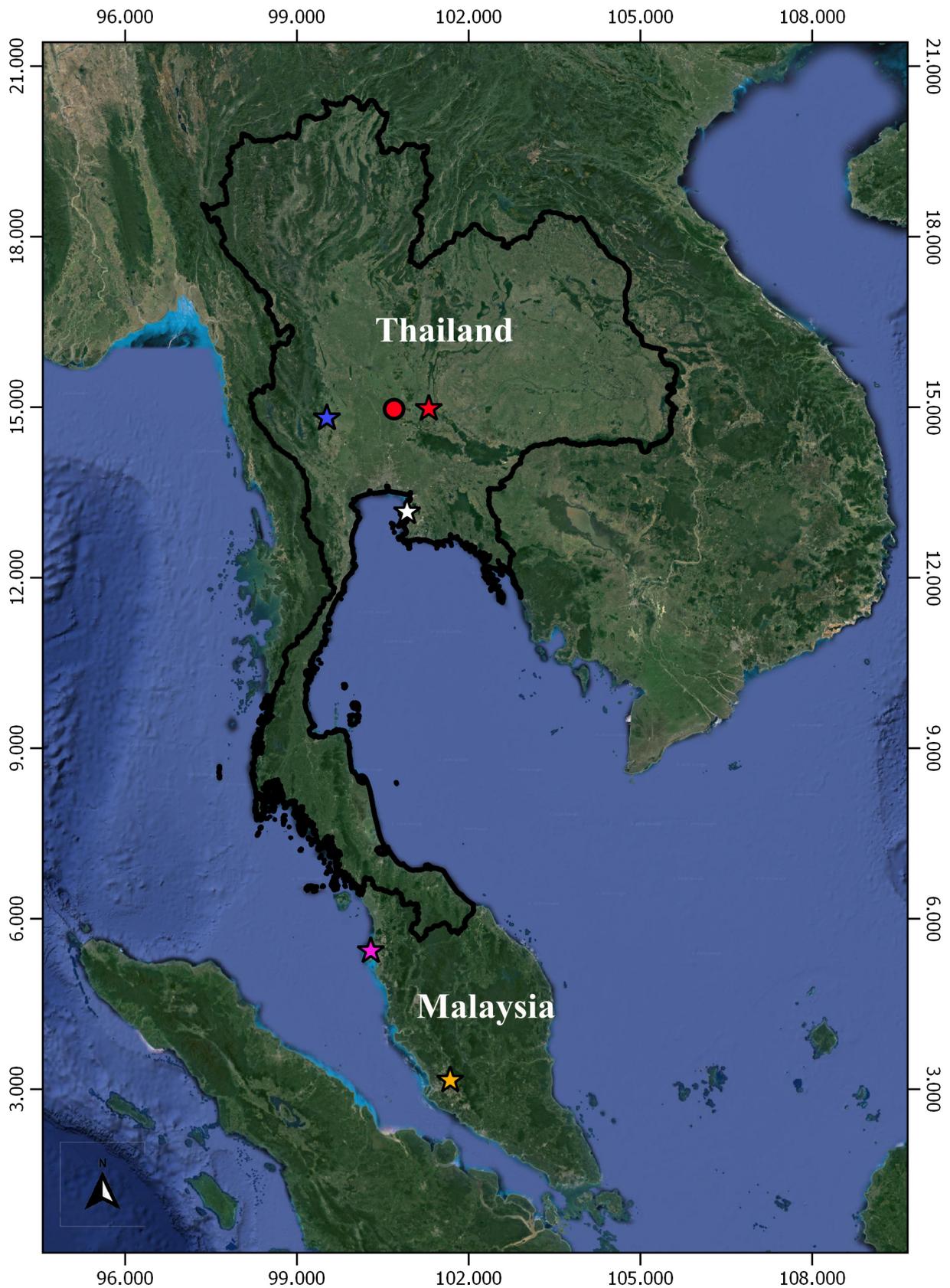
exist in the intervening area and nearby hilly areas in the neighboring Saraburi Province. Restoration actions suggested by Meesook *et al.* (2021) at Khao Chan Cave, the type-locality of *Gekko (Gekko) pradapdao* and *Gehyra wongchan* **sp. nov.**, could be beneficial to both species. We are not aware of any traditional use of *Gehyra wongchan* **sp. nov.** Its dull color and its general resemblance with *Gehyra mutilata* which is ubiquitous in urban areas throughout Thailand and widespread in the tropics, make of it a highly unlikely candidate for the international pet trade.



**FIGURE 12.** Live adult *Gehyra lacerata* from Sri Racha District, Chonburi Province, southeastern Thailand (top), and from Hua Hin District, Prachuap Khiri Khan Province, northern peninsular Thailand (bottom). Photographs by M. Sumontha.



**FIGURE 13.** Live adult *Gehyra mutilata* from Kaeng Krachan District, Phetchaburi Province, northern peninsular Thailand (top), and from Muang District, Ranong Province, southern Thailand (bottom). Photographs by M. Sumontha.



**FIGURE 14.** Map showing the distribution of *Gehyra wongchan* sp. nov. in Lopburi Province, central Thailand (in red; the star represents the type-locality), and the type-localities of taxa described from Thailand and Peninsular Malaysia: *G. angusticaudata* (white star), *G. fehlmanni* and *G. lacerata* (blue star), *Gehyra butleri* (orange star) and *Peropus packardii* (pink star), the latter two being subjective synonyms of *Gehyra mutilata*. Map by W. Sodob.



**FIGURE 15.** Biotope of *Gehyra wongchan* sp. nov. at the type-locality (entrance of Khao Chan Cave). Photograph by N. Anurakpongsathorn. Note the dramatic anthropic alteration of the natural biotope.

The present discovery further increases the long list of taxa endemic to the “Saraburi Group Limestones” (Round *et al.* 2021), including among others, *Cyrtodactylus chanhomeae* Bauer, Sumontha & Pauwels, 2003, *Dixonius melanostictus* (Taylor, 1962), *Gekko lauhachindai* Panitvong, Sumontha, Konlek & Kunya and *G. pradapdao* (Konlek & Lauhachinda 2008; Panitvong *et al.* 2010; Meesook *et al.* 2021). These recent discoveries in heavily human modified landscapes close to the megalopolis of Bangkok demonstrate that the inventory of the herpetofauna of Thailand is far from complete.

## Acknowledgements

We are grateful to the following curators for allowing us access to the *Gehyra* specimens of the herpetological collections under their responsibility: Tanya Chan-ard and Sunchai Makchai (THNHM, Pathum Thani), Ivan Ineich (MNHN, Paris) and Panupong Thammachoti and Kumthorn Thirakhupt (CUMZ, Bangkok). We thank Niran Anurakpongsathorn for providing photographs of specimens and of the type-locality, Joshua Mata and Alan Resetar (FMNH) for detailed photos of the types of *Gehyra angusticaudata* and *G. fehlmanni*, and Nikolay A. Poyarkov (Lomonosov Moscow State University, Moscow) and Philip D. Round (Mahidol University, Bangkok) for useful literature. Watchira Sodob kindly prepared the map. Paul Oliver (Australian National University, Canberra), Aaron M. Bauer (Villanova University, Villanova) and an anonymous reviewer provided useful comments on the manuscript.

## References

- Bauer, A.M., Sumontha, M. & Pauwels, O.S.G. (2003) Two new species of *Cyrtodactylus* (Reptilia: Squamata: Gekkonidae) from Thailand. *Zootaxa*, 376 (1), 1–18.  
<https://doi.org/10.11646/zootaxa.376.1.1>
- Beckon, W.N. (1992) The giant Pacific geckos of the genus *Gehyra*: morphological variation, distribution, and biogeography. *Copeia*, 1992, 443–460.  
<https://doi.org/10.2307/1446204>
- Bobrov, V.V. & Semenov, D.V. (2008) *Yascheritsy Vietnama [Lizards of Vietnam]*. Tov-vo Nauchnih Izdaniy KMK, Moscow, 226 pp., XVIII pls. [in Russian]
- Boulenger, G.A. (1900) Descriptions of two new lizards from Selangor. *Journal of the Bombay Natural History Society*, 13 (2), 333–334, pl.
- Bourret, R. (2009) *Les lézards de l'Indochine*. Edition Chimaira, Frankfurt am Main, 624 pp.
- Chan-ard, T., Grossmann, W., Gumprecht, A. & Schulz, K.-D. (1999) *Amphibians and reptiles of Peninsular Malaysia and Thailand. An illustrated checklist. Amphibien und Reptilien der Halbinsel Malaysia und Thailands. Eine illustrierte Checkliste*. Bushmaster Publications, Wuersele, 240 pp.
- Chan-ard, T., Parr, J.W.K. & Nabhitabhata, J. (2015) *A field guide to the reptiles of Thailand*. Oxford University Press, New York, New York, xxix + 314 pp.
- Cope, E.D. (1869) Observations on reptiles of the Old World. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1868, 316–323.
- de Massary, J.-C. (1992) *Comparaison morphométrique et méristique entre les populations de Gehyra mutilata (Reptilia, Gekkonidae) de l'Océan Pacifique et de l'Océan Indien*. Master Degree Thesis in Biology, Université Pierre & Marie Curie, Paris, 30 pp.
- Flower, S.S. (1899) Notes on a second collection of reptiles made in the Malay Peninsula and Siam, from November 1896 to September 1898, with a list of the species recorded from those countries. *Proceedings of the Zoological Society of London*, 1899, 600–697, pl.  
<https://doi.org/10.1111/j.1469-7998.1899.tb06880.x>
- Goldberg, S.R. & Grismer, L.L. (2016) Notizen zur Fortplanzung beim Pazifikgecko, *Gehyra mutilata* (Squamata: Gekkonidae) von der Malaiischen Halbinsel. *Sauria*, 38 (4), 56–59.
- Grismer, L.L. (2011) *Lizards of Peninsular Malaysia, Singapore, and their adjacent archipelagos. Their description, distribution, and natural history*. Edition Chimaira, Frankfurt am Main, 728 pp.
- Grismer, L.L., Chav, T., Neang, T., Wood, P.L., Grismer, J.L., Youmans, T.M., Ponce, A., Daltry, J.C. & Kaiser, H. (2007) The herpetofauna of the Phnom Aural Wildlife Sanctuary and checklist of the herpetofauna of the Cardamom Mountains, Cambodia. *Hamadryad*, 31 (2), 216–241.
- Grismer, L.L., Wood, P.L., Anuar, S., Riyanto, A., Norhayati, A., Muin, M.A., Sumontha, M., Grismer, J.L., Chan, K.O., Quah, E.S.H. & Pauwels, O.S.G. (2014) Systematics and natural history of Southeast Asian Rock Geckos (genus *Cnemaspis* Strauch, 1887) with descriptions of eight new species from Malaysia, Thailand, and Indonesia. *Zootaxa*, 3880 (1), 1–147.  
<https://doi.org/10.11646/zootaxa.3880.1.1>
- Grismer, L., Wood, P.L.Jr., Poyarkov, N.A., Le, M.D., Karunarathna, S., Chomdej, S., Suwannapoom, C., Qi, S., Liu, S., Che, J., Quah, E.S.H., Kraus, F., Oliver, P.M., Riyanto, A., Pauwels, O.S.G. & Grismer, J.L. (2021) Karstic landscapes are foci of species diversity in the World's third largest vertebrate genus *Cyrtodactylus* Gray, 1827 (Reptilia: Squamata; Gekkonidae). *Diversity*, 13 (5), 183.  
<https://doi.org/10.3390/d13050183>
- Karsen, S.J., Lau, M.W. & Bogadek, A. (1998) *Hong Kong amphibians and reptiles. Second edition*. Provisional Urban Council, Hong Kong, 186 pp.
- Konlek, K. & Lauhachinda, V. (2008) Species of reptile [*sic*] in limestone forest and religious territory, Khaowong Subdistrict, Phra Phutthabat District, Saraburi Province. *Journal of Wildlife in Thailand*, 15 (1), 54–67. [in Thai with English abstract]
- Lue, K.-Y., Chen, S.-H., Otsuka, K. & Ota, H. (1987) Distribution of gekkonid species belonging to *Hemidactylus* and *Gehyra* (Lacertilia) in Taiwan. *Mem. Fac. Sci. Kyoto University (Ser. Biol.)*, 12, 113–118.
- Manthey, U. & Grossmann, W. (1997) *Amphibien & Reptilien Südostasiens*. Natur und Tier Verlag, Münster, 512 pp.
- Meesook, W., Sumontha, M., Donbudit, N. & Pauwels, O.S.G. (2021) A new cave-dwelling *Gekko* (*Gekko*) from Lopburi Province, central Thailand (Squamata, Gekkonidae). *Zootaxa*, 4969 (2), 318–330.  
<https://doi.org/10.11646/zootaxa.4969.2.5>
- Meiri, S., Bauer, A.M., Allison, A., Castro-Herrera, F., Chirio, L., Colli, G., Das, I., Doan, T.M., Glaw, F., Grismer, L.L., Hoogmoed, M., Kraus, F., LeBreton, M., Meirte, D., Nagy, Z.T., Nogueira, C., Oliver, P., Pauwels, O.S.G., Pincheira-Donoso, D., Shea, G., Sindaco, R., Tallwin, O., Torres-Carvajal, O., Trape, J.-F., Uetz, P., Wagner, P., Wang, Y., Ziegler, T. & Roll, U. 2017. Extinct, obscure or imaginary: the lizard species with the smallest ranges. *Diversity and Distributions*, 24 (2), 262–273.  
<https://doi.org/10.1111/ddi.12678>
- Nabhitabhata, J., Chan-ard, T. & Chuaynkern, Y. (“2000” 2004) *Checklist of amphibians and reptiles in Thailand*. Office of Environmental Policy and Planning, Bangkok, 152 pp.

- Oliver, P., Siström, M., Tjaturadi, B., Krey, K. & Richards, S. (2010) On the status and the relationships of the gecko species *Gehyra barea* Kopstein, 1926, with description of new specimens and a range extension. *Zootaxa*, 2354 (1), 45–55. <https://doi.org/10.11646/zootaxa.2354.1.4>
- Oliver, P.M., Clegg, J.R., Fisher, R.N., Richards, S.J., Taylor, P.N. & Jocqué, M.M.T. (2016) A new biogeographically disjunct giant gecko (*Gehyra*: Gekkonidae: Reptilia) from the East Melanesian Islands. *Zootaxa*, 4208 (1), 61–76. <https://doi.org/10.11646/zootaxa.4208.1.3>
- Panitvong, N., Sumontha, M., Konlek, K. & Kunya, K. (2010) *Gekko lauhachindai* sp. nov., a new cave-dwelling gecko (Reptilia: Gekkonidae) from central Thailand. *Zootaxa*, 2671, 40–52.
- Pauwels, O.S.G., Kunya, K. & Bauer, A.M. (2008) Geographic distribution. *Gehyra lacerata* (Kanchanaburi Four-clawed Gecko). *Herpetological Review*, 39 (2), 238.
- Pauwels, O.S.G., Panitvong, N., Kunya, K. & Sumontha, M. (2021) A new sandstone-dwelling leaf-toed gecko (Gekkonidae: *Dixonius mekongensis*) from the Thai-Lao border. *Zootaxa*, 4969 (3), 526–538. <https://doi.org/10.11646/zootaxa.4969.3.5>
- Ponta, G., Memon, B., LaMoreaux, J., Julawong, J. and Wongsawat, S. (2013) Karst Landforms in the Saraburi Group Limestones, Thailand. *Conference Paper, National Cave and Karst Research Institute Symposium*, 2013, 2. <https://doi.org/10.5038/9780979542275.1140>
- Rösler, H. & Scheidt, U. (2013) Die herpetologische Sammlung des Naturkundemuseums Erfurt 1. Teil: Verzeichnis der Geckos (Reptilia: Squamata: Gekkota). *Vernate*, 32, 235–256.
- Round, P.D., Tantipisanuh, N., Eiamampai, K. & Asensio, N. (2021) The threatened Rufous Limestone Babbler *Gypsophila calcicola*—not a quarry species, but a “quarried species”. *Bird Conservation International*, First View, 1–9. <https://doi.org/10.1017/S0959270921000277>
- Smith, M.A. (1935) *The Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II. Sauria*. Taylor and Francis, London, xiii + 440 pp., 1 pl., 2 folding maps.
- Tanalgo, K.C. & Hughes, A.C. (2017) First evidence of nectarivory by four-clawed gecko, *Gehyra mutilata* (Wiegmann, 1834) (Squamata: Gekkonidae) on a batpollinated Calabash tree (*Crescentia cujete* L.) (Bignoniaceae) in Southcentral Mindanao, Philippines. *Herpetology Notes*, 10, 493–496.
- Taylor, E.H. (1962) New Oriental reptiles. *University of Kansas Science Bulletin*, 43, 209–263. <https://doi.org/10.5962/bhl.part.13346>
- Taylor, E.H. (1963) The lizards of Thailand. *University of Kansas Science Bulletin*, 44, 687–1077.
- Teynié, A. & David, P. (2010) *Voyages naturalistes au Laos. Les reptiles. Société d'Histoire Naturelle Alcide-d'Orbigny*. Éditions Revoir, Nohant, 315 pp.
- Uetz, P., Freed, P. & Hošek, J. (Eds.) (2021) The Reptile Database. Available from: <http://www.reptile-database.org> (accessed 5 November 2021)
- Vassilieva, A.B., Galoyan, E.A., Poyarkov, N.A. & Geissler, P. (2016) *A photographic field guide to the amphibians and reptiles of the lowland monsoon forests of southern Vietnam*. Edition Chimaira, Frankfurt am Main, 324 pp.
- Warren, J., Morley, C.K., Charoentitirat, T., Cartwright, I., Ampaiwan, P., Khositichaisri, P., Mirzaloo, M. & Yingyuen, J. (2014) Structural and fluid evolution of Saraburi Group sedimentary carbonates, central Thailand: a tectonically driven fluid system. *Marine and Petroleum Geology*, 55, 100–121. <https://doi.org/10.1016/j.marpetgeo.2013.12.019>
- Wiegmann, A.F.A. (1834) Amphibien. In: Meyen, F.J.F., *Reise um die Erde ausgeführt auf dem Königlich Preussischen Seehandlungs-Schiffe Prinzess Louise, comandiert von Capitain W. Wendt, in den Jahren 1830, 1831 und 1832. von Dr. F.J.F. Meyen*. Dritter Theil. Zoologischer Bericht. Sander'schen Buchhandlung (C. W. Eichhoff), Berlin, pp. 433–522, pls. LII–LXI.
- Zhao, E. & Adler, K. (1993) *Herpetology of China*. Society for the Study of Amphibians and Reptiles, Oxford, 522 pp.

**APPENDIX.** Comparative material examined. The number of specimens is specified when it is above one. spec. = specimens. Four specimens, indicated with asterisks\*, were examined only through detailed photographs.

- Gehyra angusticaudata*: Thailand: FMNH 178203\* (holotype) & FMNH 178204\* (paratype), “Siracha, Chon Buri Prov.”
- Gehyra fehlmanni*: Thailand: FMNH 178207\* (holotype), “4 Km NW Kanchanaburi, Kanchanaburi Prov.” FMNH 178237\* (paratype), “Tonka Harbour Tin Mine, Ronpibon, Nakhon Si Thammarat Prov.” RBINS 20046 & RBINS 20048, “near Ban Tha Sao, Sai Yok Dist., Kanchanaburi Prov.”
- Gehyra lacerata*: Thailand: RBINS 16684, “Khao Kheeo-Khao Chompoo, Sriracha Dist., Chonburi Prov.” RBINS 17021, “Ban Phoo Toom, Ban Lat Dist., Phetchaburi Prov.” RBINS 17032, “Hin Chang See, Ban Fang Dist., Khon Kaen Prov.” (Pauwels *et al.* 2008). THNHM 1329, Forestry Training Center, Cha-am, Cha-am Dist., Phetchaburi Prov.”
- Gehyra leopoldi*: RBINS 2028 (holotype), “Sorong et Manoi, Nouvelle Guinée”.
- Gehyra mutilata*: Indonesia: RBINS 126 (2 spec.), “Wonosobo, Java”. RBINS 126B (3 spec.), “Buitenzorg, Java.” RBINS 126D (2 spec.) & RBINS 126E (7 spec.), “Tjandikoesoema, W. Bali”. RBINS 126Y (7 spec.), “S. Manoembaai” [= Soengai Manoembaai (ca. 6°1'37.08"S, 134°18'52.40"E), Aru Islands]. RBINS 126S & RBINS 752, “Indes Néerlandaises.” RBINS 752E (2 spec.) & RBINS 752S, “Amboine.” RBINS 752G, “Salajala.” RBINS 790, “Sumatra.” RBINS 790Y & RBINS 790B (7 spec.), “Batavia, Java.” RBINS 790d, “Indes Orientales.” Mauritius: RBINS 11968, “Vacoas, Ile Maurice”. RBINS

11969, "Curepipe, Ile Maurice". Papua New Guinea: RBINS 13879 (2 spec.), "Laing Island, Madang Province." Philippines: RBINS 17252, "Mayoyao, Ifugao Prov., Luzon Island." RBINS 17267–17269, "Lake Sebu, Lake Sebu Municipality, 700 m asl, Mindanao Island." Thailand: CUMZ(R) 1999.07.15.2–3, MNHN 1999.7602–7605, RBINS 15468–15471 & RBINS 17030, "Ban Salakern, Ban Lat Dist., Phetchaburi Prov." MNHN 1999.7703–7705 & RFD (field nrs P[auwels] 202–203), "Ko Boi Yai, Ko Yao Dist., Phang-Nga Prov." RBINS 17031, "Hin Chang See, Ban Fang Dist., Khon Kaen Prov." RBINS 17033–17035, "Sakaerat, Nakhon Ratchasima Prov." No country/locality: RBINS 752B & RBINS 752D.

*Gehyra rohan*: RBINS 2684 (holotype), "Lorengau, Manus Island, Papua New Guinea". RBINS 2685 (paratype), "Yiringou, Manus Island, Papua New Guinea".

*Gehyra spp.*: Thailand: RBINS 16644, "Tham (Cave) Phra Khayang, Khao Laem Niang, Kraburi Dist., Ranong Prov." RBINS 16648 & RBINS 20047, "Phraya Chattan Cave, on limestone hill, Phraputthabata Dist., Saraburi Prov." RBINS 16651, "Khao Bo Teui, Ban Chao Law, Klong Khut Subdist., Tha Mai Dist., Chanthaburi prov." RBINS 19353, "Doi Suthep, Chiang Mai Prov." RBINS 19354–19355, "Tham (Cave) Nang Noowan, Khao Yai Subdist., Cha-am Dist., Phetchaburi Prov."