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Hiding in plain sight: a new species of bent-toed gecko (Squamata: Gekkonidae: *Cyrtodactylus*) from West Timor, collected by Malcolm Smith in 1924

ANDREW KATHRINER¹, AARON M. BAUER², MARK O'SHEA³,
CAITLIN SANCHEZ⁴ & HINRICH KAISER^{4,5,6}

¹Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA; present address: Department of Herpetology, Bronx Zoo, 2300 Southern Boulevard, Bronx, New York 10460, USA

²Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA

³Faculty of Science and Engineering, University of Wolverhampton, Wulfruna Street, Wolverhampton, West Midlands, WV1 1LY, United Kingdom; and West Midland Safari Park, Bewdley, Worcestershire, DY12 1LF, United Kingdom

⁴Department of Biology, Victor Valley College, 18422 Bear Valley Road, Victorville, California 92395, USA

⁵Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013, USA

⁶Corresponding author. E-mail hinrich.kaiser@vvc.edu

Abstract

We describe a new species of bent-toed gecko from a single specimen initially collected in 1924 by Malcolm Smith on Timor Island in the Lesser Sunda Archipelago of Indonesia. *Cyrtodactylus celatus* sp. nov. is distinguished from all other congeners by the following combination of characters: small adult size; without spinose tubercles on the ventrolateral body fold and along the lateral margin of the tail; 16 longitudinal rows of tubercles at midbody; 42 ventral scales between the ventrolateral folds at midbody; no transversely enlarged, median subcaudal scales; 17 subdigital lamellae (seven basal + ten distal) under the fourth toe; no abrupt transition between postfemoral and ventral femoral scale series. The specimen is the earliest confirmed record of the genus *Cyrtodactylus* for Timor, and it is the first putatively endemic gecko species described from this island.

Key words: Gekkonidae, *Cyrtodactylus*, new species, Lesser Sunda Archipelago, West Timor, Indonesia, description, taxonomy, osteology, Malcolm Smith

Introduction

The genus *Cyrtodactylus* is the most diverse gekkonid genus with 196 species (Uetz 2014) and recent studies on the genus have improved our ability to define species boundaries (e.g., Rösler & Glaw 2008, Grismer *et al.* 2012b), as the pace of herpetological fieldwork in Southeast Asia has accelerated (e.g., Bauer 2002, 2003—Myanmar; Das 2004—Borneo; Grismer *et al.* 2011—Indochina and Malaysia; Kaiser *et al.* 2011—Timor; Linkem *et al.* 2008, Iskandar *et al.* 2011—Sulawesi; Setiadi *et al.* 2011—Indonesia). *Cyrtodactylus* is a geographically wide-ranging genus with species occupying diverse ecological niches. Species of *Cyrtodactylus* are found in mainland Asia, as far northwest as northern India, Nepal, and Tibet, and members of the genus are more-or-less continuously distributed eastwards throughout Southeast Asia and the Indo-Australian Archipelago, reaching the Philippines, New Guinea, northern Australia, and the Solomon Islands (Rösler & Glaw 2008; Uetz 2014; Wood *et al.* 2012). In view of this broad distribution, the relative paucity of known forms from the ecologically diverse Lesser Sunda Archipelago (Fig. 1), currently limited to *C. darmandvillei* (Weber, 1890), *C. gordongekkoi* (Das, 1993), *C. laevigatus* Darevsky, 1964 and its subspecies *C. l. laevigatus* and *C. l. uniformis* Auffenberg, 1980, and *C. wetariensis* (Dunn, 1927), is intriguing.

Known for a turbulent and sometimes violent political history ever since the arrival of European colonizers in the early 1500s, the island of Timor plays a particularly interesting biogeographic role in the region. Whereas the Lesser Sunda Islands in the Inner Banda Arc (including Bali, Lombok, Sumbawa, Flores, and Wetar) are volcanic

in origin, those in the Outer Banda Arc (including Sumba and Timor) were formed from uplifted mixed sediments as a consequence of northward shifts by the Australian Plate (Fig. 1; Monk *et al.* 1997). As a consequence of their position between Australia and the Inner Banda Arc, the herpetofaunas of Timor and Sumba appear to be biogeographic mosaics (Mertens 1930; Forcart 1953; Kaiser *et al.* 2011), comprising elements of the Southeast Asian fauna (e.g., the treefrog *Polypedates leucomystax*-complex, the sun skink *Eutropis multifasciata*-complex, several species of house geckos, genus *Hemidactylus*), the Australian fauna (e.g., glossy night skinks, genus *Eremiascincus*; four-fingered skinks, genus *Carlia*), and even the Papuan fauna (e.g., ground snakes, genus *Stegonotus*). A careful study of the systematics of these faunal elements may permit the tracing of dispersal routes and the timing of colonizations in this complex archipelago.

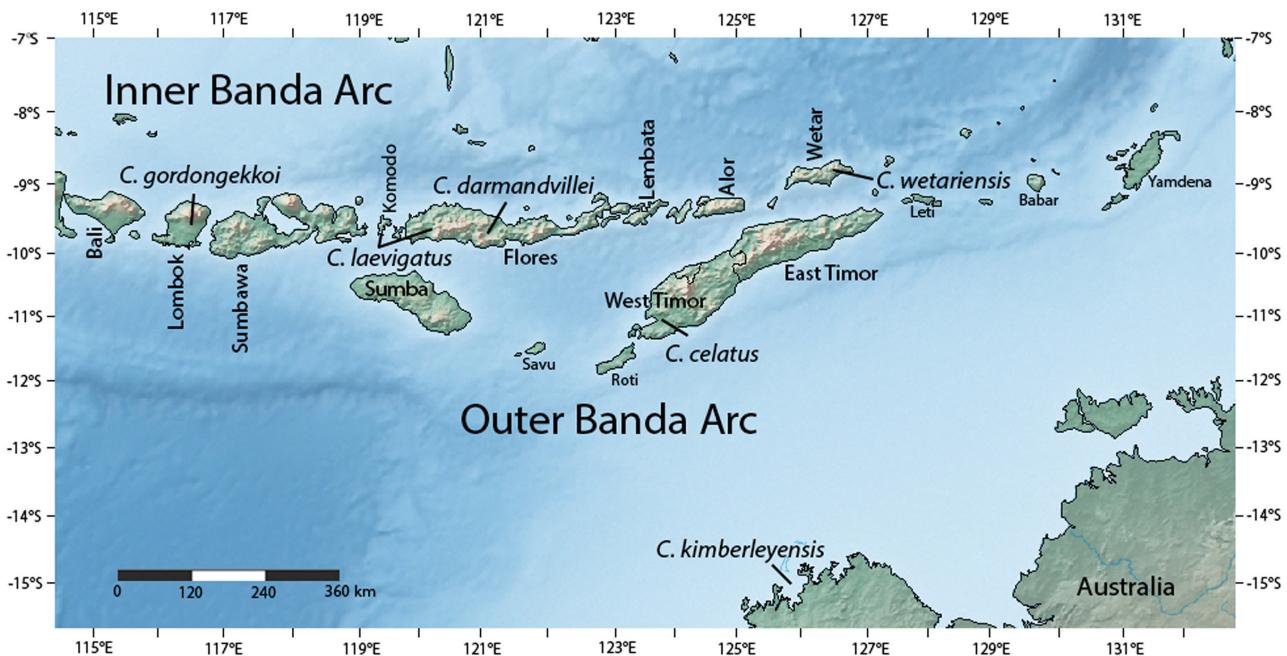


FIGURE 1. Map of the Lesser Sunda Islands showing the positions of the Inner and Outer Banda Arc as well as type localities of *Cyrtodactylus* endemic to this archipelago.

Recent survey work (e.g., Kaiser *et al.* 2011, 2013; O’Shea *et al.* 2012; Sanchez *et al.* 2012) has revealed the existence of at least four new species of *Cyrtodactylus* in Timor-Leste, the eastern part of Timor. The only earlier literature record for the genus on the island was a short notation by Smith (1927), who listed “*Gymnodactylus* (?) *marmoratus* (Kuhl)” from “Djamplong, S. Timor” (Fig. 2) among his collection, but gave no further details. The species designation itself raised questions, however, because what is called *Cyrtodactylus marmoratus* (Gray, 1831) today, is a species whose distribution does not extend into the Lesser Sundas (Dring 1979; Rösler *et al.* 2007). The purported presence of *C. marmoratus* on Timor based on Smith’s record was already noted as an oddity by Mertens (1930), who considered this record to require further confirmation. Subsequently, Smith’s specimen was referred to *C. wetariensis* by Brongersma (1953), although it is not possible to determine from Brongersma’s publication whether the author actually saw Smith’s specimen or based his decision on a biogeographic likelihood. As discussed by Sanchez *et al.* (2012), the single specimen of “*Gymnodactylus Timorensis*” (Duméril & Bibron, 1836) is not a *Cyrtodactylus* and not from Timor (L.L. Grismer, in prep.; HK, pers. obs.). This leaves Smith’s specimen, which he deposited in The Natural History Museum, London (BMNH), as the oldest verified record of *Cyrtodactylus* for Timor.

Smith (1927) provided no specimen number and carried out no further research on the specimen, which is still extant, labeled as “BMNH 1926.10.30.45 *Gymnodactylus marmoratus*” but with an anonymous hand-written additional label inside the jar referring the specimen to *Cyrtodactylus wetariensis*. Examination of the specimen and comparison with the type material for *C. marmoratus* and *C. wetariensis* reveal that Smith’s specimen is the only known specimen of an undescribed species of *Cyrtodactylus* from West Timor, which we describe herein.

Material and methods

Characters used for evaluating and comparing specimens are listed in Table 1. Measurements were taken with digital calipers to the nearest 0.1 mm following the methods of Bauer (2002, 2003). Scale counts were made on a Wild Dissecting Microscope with a Unitron gooseneck illuminator. Basal subdigital lamellae were counted from the most proximal lamella at least twice as large as adjacent palmar scales. Measurements and scale counts were based on the right side of animals unless otherwise noted. X-rays of the holotype were taken using a Kevex PXS5-724EA emitter and a Varian PanScan 4030R receiver (40 kV target tube voltage) at the Museum Support Center of the U.S. National Museum of Natural History, Smithsonian Institution, Suitland, Maryland, USA. For each of the species we include in our comparisons, we evaluated museum specimens in addition to comparative literature. Museum abbreviations are taken from Sabaj Pérez (2014).

TABLE 1. Mensural and meristic characters used in this study with abbreviations.

Description	Abbreviation	Comment
Snout-vent length	SVL	Tip of snout to vent
Head length	HeadL	Tip of snout to posterior margin of retroarticular process of lower jaw
Head width	HeadW	At the angle of the jaws
Head depth	HeadD	Maximum depth of head from occiput to throat
Eye-to-snout distance	EyeS	Tip of snout to anterior most margin of eye
Eye-to-nostril distance	EyeN	Anterior margin of eye to posterior margin of nares
Eye-to-ear distance	EyeEar	Anterior edge of ear opening to posterior margin of eye
Ear length	EarL	Distance from anterior edge to posterior edge of ear
Orbital diameter	OrbD	Measured between anterior edge of orbit to posterior edge
Interorbital distance	IO	Measured between medial edges of the orbit across the occiput
Internarial distance	IN	Measured between the medial edges of the nares across the rostrum
Forelimb length	FL	Insertion point of forelimb to wrist
Number of longitudinal tubercle rows	Tub Row	Counted at mid-body
Number of ventral scale rows	VScaleRow	Counted across mid-abdomen
Total precloacal pores	TPore	Counted at anterior edge of cloaca
Total femoral pores	FemPore	Counted across ventral surface of thighs

Cyrtodactylus celatus sp. nov.

Smith's Hidden Bent-toed Gecko

Figs. 2–6

Gymnodactylus (?) *marmoratus* (Kuhl)—Smith 1927:201

Gymnodactylus marmoratus Duméril & Bibron (sic) [part]—Mertens 1930:239

Gymnodactylus wetariensis Dunn [part]—Brongersma 1953:174

Cyrtodactylus marmoratus [part]—Bauer & Henle 1994:27

Holotype. BMNH 1926.10.30.45 (Figs. 2–5), an adult female specimen from “Djamplong, 55 kilometres by road from Kupang,” now Tjamplong (or Camplong), West Timor, Nusa Tenggara Timur Province, Indonesia, collected by Malcolm Smith between 26 February and 29 April 1924.

Diagnosis. *Cyrtodactylus celatus* is a small (SVL of only known specimen 38.4 mm) species of *Cyrtodactylus*, distinguished from all other Sunda Shelf species by having large, elongate, conical, keeled tubercles on body, limbs, and tail; elongate, tubercles absent on the ventrolateral body fold and on the ventrolateral margin of the tail; 16 longitudinal rows of tubercles at midbody; 42 ventral scales between the ventrolateral folds; no transversely

enlarged, median, subcaudal scales, uniform granular caudal scales; proximal subdigital lamellae transversely expanded; 17 subdigital lamellae (seven basal + ten distal) on the fourth toe; no abrupt transition between postfemoral and ventral femoral scales; no digital webbing; tail round in cross-section; ventrolateral caudal fringe lacking; no white reticulations on the head; and faint, squarish blotches on the body.



FIGURE 2. Holotype of *Cyrtodactylus celatus* sp. nov. (BMNH 1926.10.30.45). (Top) Dorsal view. (Bottom) Ventral view. Units on the scale are in centimeters.

Description of the holotype. An adult female (as determined by the condition of the primarily fused epiphyses and the presence of oviducts and yolk particles within the body cavity), SVL 38.4 mm; head (Fig. 3A) moderate in length (HeadL/SVL 0.23), wide (HeadW/HeadL 0.57), somewhat flattened (HeadD/HeadL 0.40), distinct from neck, triangular in dorsal profile; lores weakly inflated, prefrontal region concave, canthus rostralis smoothly rounded; snout elongate (EyeS/HeadL 0.46) rounded in dorsal profile; eye large (OrbD/HeadL 0.23); ear opening oval, moderate in size (EarL/HeadL 0.07), vertically oriented; EyeEar > OrbD; rostral wider than high, concave, partially divided dorsally, bordered dorsally by left and right supranasals and two medial postrostrals (= internasals), bordered laterally by first supralabials and external nares; external nares bordered dorsally by a single, small supranasal, posteriorly by several granular postnasals, ventrally by first supralabial; 11 (R,L) square supralabials extending to just beyond dorsal inflection of labial margins (Fig. 3A), beginning to taper off in size below midpoint of eye, first supralabial largest, three posteriormost supralabials small, the last of which is split into two scales one above the other; 10 (R,L) infralabials, tapering off smoothly in size posteriorly to beyond orbit, terminal scale in series raised; scales of rostrum and lores enlarged, larger than granular scales on top of head and occiput; scales of occiput intermixed with enlarged, spinose tubercles; dorsal supraciliaries small, flat; mental triangular, bordered laterally by first infralabials and posteriorly by left and right elongate postmentals which contact medially for 60% of their length; 1° postmentals bordered by large 2° postmentals (Fig. 3D,E, 6A,B), followed by two rows of slightly enlarged 2° postmentals extending posteriorly to the sixth infralabial; gular scales small, granular, grading posteriorly into slightly larger, flatter, throat scales that grade into larger, flat, smooth, imbricate, pectoral and ventral scales.

Body relatively short with well-defined ventrolateral folds (Fig. 4A,B); dorsal scales small, granular, interspersed with large, conical, semi-regularly arranged, keeled tubercles; tubercles extend from occiput to tip of tail; tubercles on occiput and temporal region spinose; those on paravertebral and lateral margin of nape and posterolateral margin of head slightly elongate; tubercles on flanks larger than on nape, with keels positioned dorsomedially; approximately 16 longitudinal rows of tubercles at midbody; 23 paravertebral tubercles; 42 smooth, flat, imbricate, ventral scales between ventrolateral body folds (Fig. 4B); ventral scales slightly larger than dorsal scales.

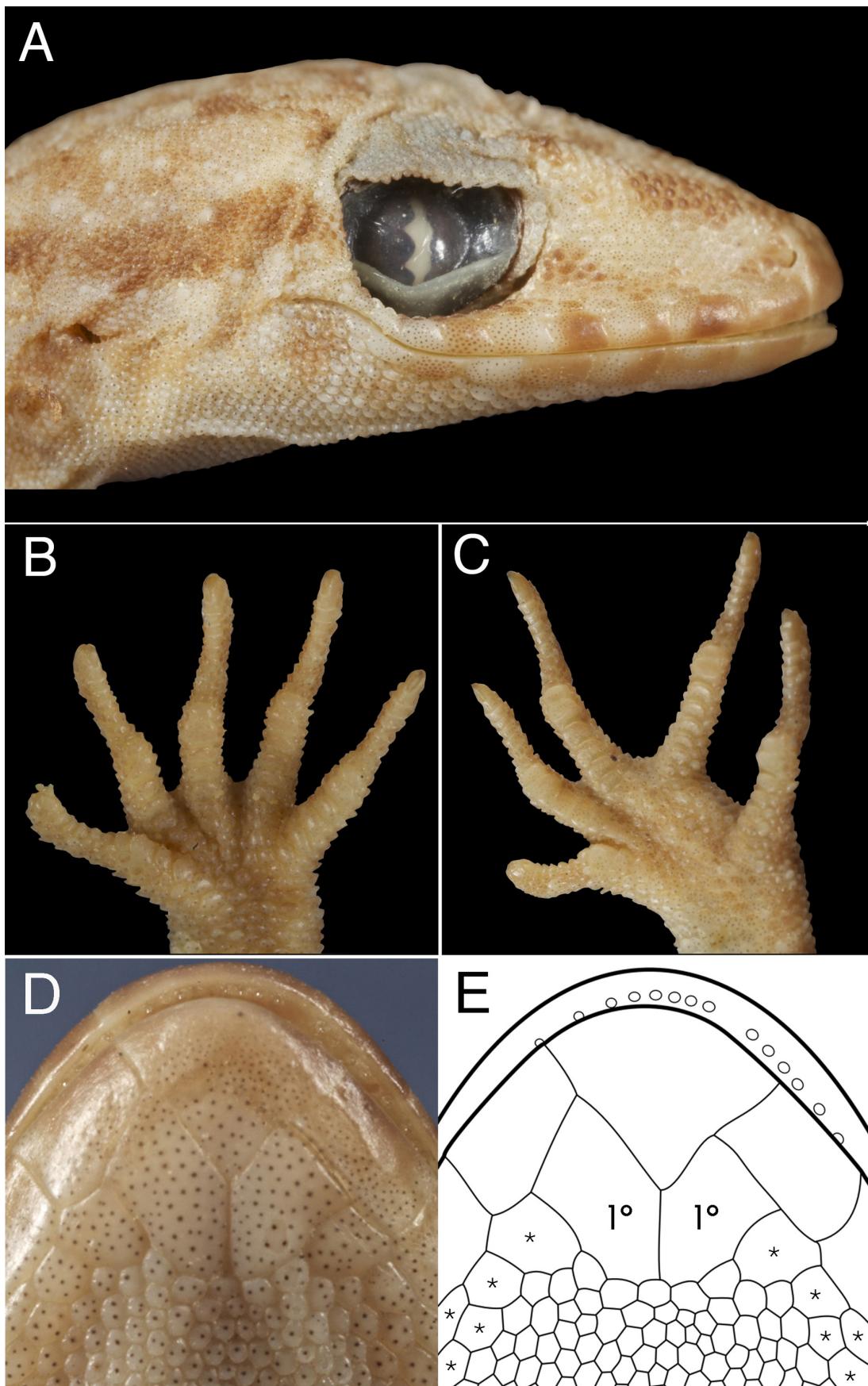


FIGURE 3. Holotype of *Cyrtodactylus celatus* sp. nov. (BMNH 1926.10.30.45). (A) Lateral view of the head, to illustrate snout, eye, and ear proportions and labial scales. (B) Palmar view of left hand. (C) Plantar view of left hind foot. (D) Chin shield pattern. (E) Line drawing of chin shields identifying primary (1°) and secondary (*) postmental shields.

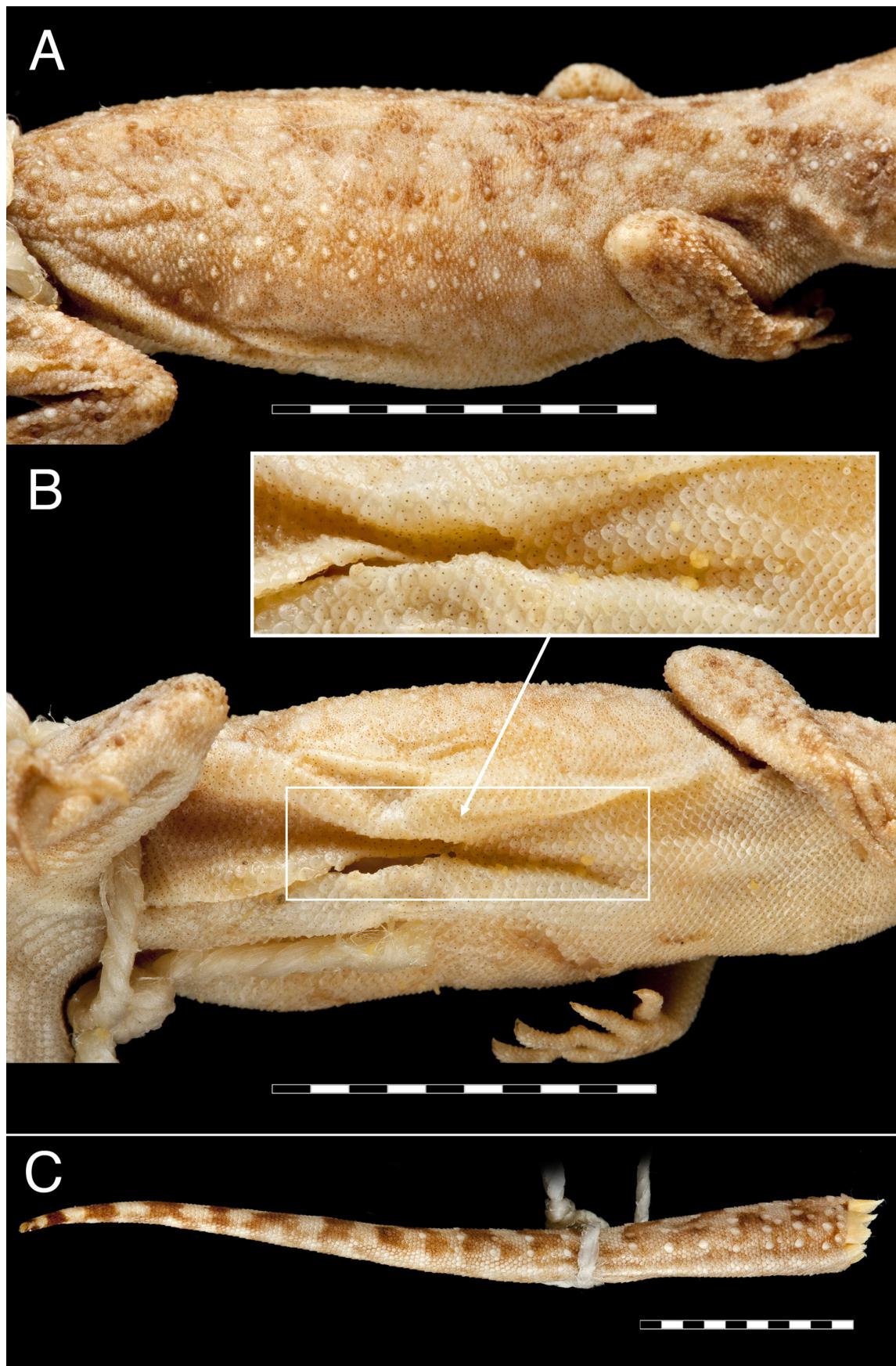


FIGURE 4. Holotype of *Cyrtodactylus celatus* sp. nov. (BMNH 1926.10.30.45). (A) Lateral view at midbody. (B) Ventral view at midbody. The inset shows the mid-ventral area and the resident mites. (C) Lateral view of broken tail, illustrating dorsal tubercles. Scale bar = 10 mm.



FIGURE 5. X-ray of the holotype of *Cyrtodactylus celatus* sp. nov. (BMNH 1926.10.30.45), showing substantial epiphyseal fusion.

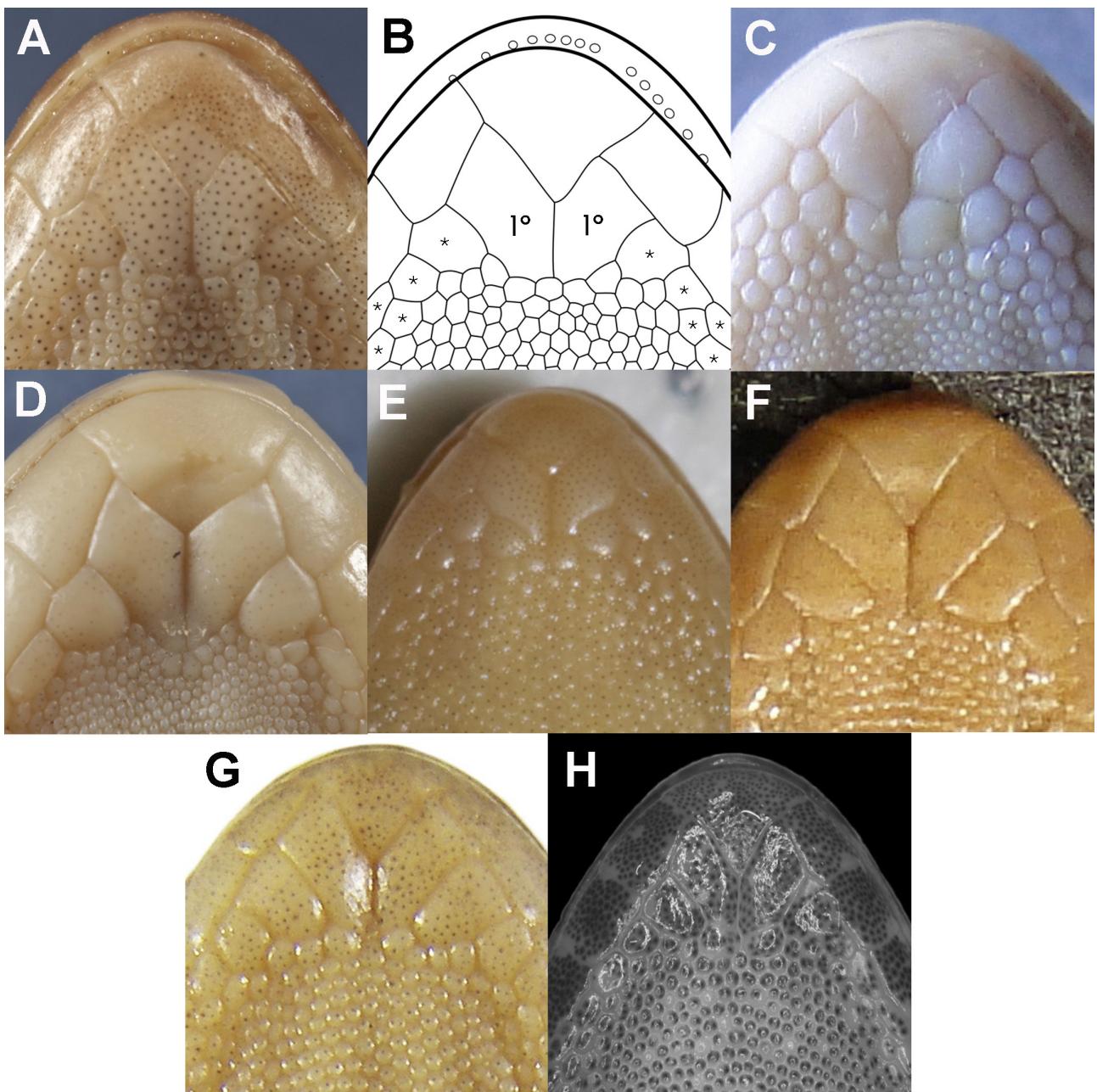


FIGURE 6. Chin shields of the five known species of Lesser Sunda *Cyrtodactylus*, the Javan *C. marmoratus*, and the Australian *C. kimberleyensis*. (A) *C. celatus* sp. nov. (holotype: BMNH 1926.10.30.45). (B) Schematic of chin shields to illustrate the presence and position of 1° and 2° postmental shields in *C. celatus* sp. nov. Asterisks (*) are used to indicate 2° postmentals. (C) *C. marmoratus* (lectotype: RMNH 2710A). (D) *C. darmandvillei* (syntype: ZMA 10943). (E) *C. laevigatus* (FLMNH 28911). (F) *C. wetariensis* (holotype: AMNH 32165). (G) *C. gordongekkoi* (paratype: ZRC 2.3381). (H) *C. kimberleyensis* (holotype: WAM R164144); from Bauer & Doughty (2012). Clear differences exist in the shape and size of the paired 1° and 2° postmentals as well as in the arrangement of the smaller scales with respect to their number and position along the infralabial scales.

Forelimbs relatively short (FL/SVL 0.15) and robust (Fig. 2); granular scales of forearm slightly larger than those of body, interspersed with large, conical, keeled tubercles; palmar scales flat, smooth, subimbricate; digits well-developed, inflected at basal interphalangeal joints; subdigital lamellae transversely expanded along the entire length of each digit, but slightly compressed in both length and width immediately distal to interphalangeal inflection, digits slightly narrower distal to inflection (Fig. 3B); 15 (R,L) subdigital lamellae on 4th fingers; claws well-developed, sheathed by two dorsal and one ventral scales; hind limbs more robust than forelimbs, moderate in length (FL: 5.8 mm; CL: 6.9 mm), covered dorsally by granular scales interspersed with larger, conical tubercles

and covered anteriorly by flat, slightly larger imbricate scales mixed with fewer, smaller tubercles; ventral scales of thigh rounded, smooth, subimbricate to juxtaposed, larger than dorsals; ventral tibial scales flat, imbricate; no enlarged femoral scales, postfemoral scales grade smoothly into slightly smaller dorsal femoral scales on posteroventral margin of thigh; plantar scales slightly raised, imbricate; digits well-developed, inflected at basal, interphalangeal joints (Fig. 3C); subdigital lamellae transversely expanded along the entire length of each digit, but slightly compressed in both length and width immediately distal to interphalangeal inflection; digits narrower distal to joints; 17 (R,L) subdigital lamellae on 4th toes; claws well-developed, sheathed by two dorsal and one ventral scales; details of lamellae include: Lamella 6 of 4th toe 1.5 times larger than each of the five more basal lamellae, twice as large as Lamella 7; proximal lamellae up to the interphalangeal joint (Lamellae 1–6) wide; Lamellae 8–10 fragmented; distal lamellae (11–17) narrow, wrapping around the digit (Fig. 3C).

Original tail present but separated from body, longer than SVL (tail length = 44.6 mm), 4.0 mm in width at base, tapering to a point (Fig. 4C); caudal scales flat to slightly raised; no median row of transversely enlarged subcaudal scales; subcaudal scales slightly larger than dorsal caudal scales; six longitudinal rows of large, spinose, caudal tubercles per tail whorl; caudal tubercles extend 90% of the length of tail, reducing to four rows then two rows in posterior 10%; two enlarged, postcloacal tubercles at base of tail; all postcloacal scales flat, imbricate.

Additional measurements (in mm). FL 12.2, HeadL 22.6, HeadW 16.0, HeadD 8.4, OrbD 5.1, EyeEar 6.8, EyeS 10.5, EyeN 7.8, IO 4.5, EarL 1.6, IN 2.6.

Coloration in preservative. The specimen has been preserved for 90 years, presumably in 70% ethanol. The head and dorsum are light brown with various irregular dark brown markings (Fig. 2). Head markings include some irregular blotches, as well as a more defined linear pattern, a dark stripe of irregular width that begins at the second supralabial, runs through the orbit and frames the posterior edge of the occiput (Fig. 3A). There are two short, broad stripes behind each nostril. Labials with alternating light and dark pattern; gular and ventral scales of body tan. The dorsum has faded, allowing only a very basic evaluation of patterning. It appears that irregularly shaped light and dark elements alternate on the dorsum in a diffuse transverse banding pattern that does not extend to the lateral areas, where any darker coloration is irregular and ill-defined. The alternating dark-light pattern of the dorsum extends onto the tail, where it is bolder and the alternating bands become narrower. The entire tail is banded, more irregularly basally, then more regularly distally.

Osteology. Parietal bones paired; ten premaxillary teeth, approximately 30 teeth on each maxillary bone. Phalangeal formulae 2-3-4-5-3 (forelimb) and 2-3-4-5-4 (hind limb). Three mesosternal ribs; 26 presacral vertebrae, including five cervical, 21 trunk, and two sacral vertebrae; 34 caudal vertebrae; five pygal vertebrae with first autotomy plane occurring in the sixth caudal vertebra, where the tail is broken (Fig. 5). Substantial epiphyseal fusion present, confirming that the specimen is an adult independent of the presence of yolk remnants.

Etymology. The species name *celatus* is a Latin adjective, meaning ‘hidden away.’ We use it to describe this species not only because the specimen remained hidden behind a single line of Smith’s (1927) contribution and on the shelves of the BMNH, but also because it has taken nearly 200 years since the initial herpetological survey work on Timor to describe the first putatively endemic member of this diverse gecko genus from that island.

Species comparisons. Whereas the holotype of *Cyrtodactylus celatus* is quite small (SVL = 38.4 mm), it is clearly an adult, as confirmed by the mature ossification observed in skeletal elements via x-ray (Fig. 5) and by the presence of yolk remnants. Size alone separates it from the majority of larger-bodied congeners (Table 2). We here compare *C. celatus* to the other species of *Cyrtodactylus* found in the Lesser Sunda Archipelago (*C. darmandvillei*, *C. gordongekkoi*, *C. l. laevigatus*, *C. l. uniformis*, *C. marmoratus*, *C. wetariensis*) and the recently described Australian *C. kimberleyensis* Bauer & Doughty, 2012; the relevant characteristics of these species are given in parentheses, and further comparative data are listed in Table 2. *Cyrtodactylus celatus* is distinguishable from *C. darmandvillei* by small body size (max. SVL 86 mm; Auffenberg 1980), granular subcaudals (transversely enlarged median subcaudals), 16 longitudinal rows of tubercles (18–20 rows), no tubercles on the lateral skin fold (presence of tubercles on the lateral skin fold), 17 subdigital lamellae on the 4th toe (20–22 lamellae), 42 ventral scales (36–40 ventrals), and a well-developed striped dorsal pattern (e.g., Auffenberg 1980: Fig. 13); from *C. gordongekkoi* by small body size (max. SVL 73 mm), 10 infralabial scales (12 infralabials), 18 longitudinal rows of tubercles (16 rows), 17 subdigital lamellae on the 4th toe (19–21 lamellae), 42 ventral scales (30 ventrals), and a dark-light patterned head and dorsum (no alternating dark-light patterning; Das, 1993: Plate 1); from *C. kimberleyensis* in having 11 supralabial scales (9–10 supralabials), 42 ventral scales (36 ventrals), 17 lamellae on the 4th toe (15 lamellae), and by a dorsal pattern comprising alternating light and dark elements that appear to form

a diffuse transverse banding pattern (dorsum devoid of dark-light patterning; Bauer & Doughty 2012: Figs. 2, 5); from *C. marmoratus* *sensu stricto* (lectotype) by small body size (SVL 82 mm), absence of a precloacal groove (present); 17 subdigital lamellae on the 4th toe (20–24 lamellae), and 2° postmentals (Fig. 6A,B) that are barely larger than the adjacent granular gular scales (one row of enlarged 2° postmentals present; Fig. 6C); from both currently recognized subspecies of *C. laevigatus* by possessing 16 longitudinal rows of tubercles (18 rows), size of dorsal tubercles on the mid-dorsum ca. 4–5 dorsal scales per tubercle (ca. 2–3 scales per tubercle), 42 ventral scales (30–33 ventrals), 17 subdigital lamellae on the 4th toe (13–15 lamellae) and the presence of alternating dark-light dorsal patterning (no dorsal patterning present); and from *C. wetariensis* in having a smaller body size (max. SVL 70 mm), 11 supralabial scales (9–10 supralabials), 10 infralabial scales (8–9 infralabials), 42 ventrals (38–40 ventrals), and the size of dorsal tubercles on the mid-dorsum ca. 4–5 dorsal scales per tubercle (ca. 8–10 scales per tubercle). All Lesser Sunda *Cyrtodactylus* also differ from one another and from the new species in the number, size, and surface area of postmentals and granular scales observed between and immediately posterior to these chin shields (Fig. 6).

Natural history. The presence of eggs in the oviduct at the time of collection suggests that oviposition occurs during the wet season (December–April) for this species. The specimen has several mites attached to the venter (Fig. 3B inset).

TABLE 2. Measurements and scale counts of Lesser Sunda *Cyrtodactylus*. Since the only known specimen of *Cyrtodactylus celatus* is a female, we have not used the numbers of precloacal and femoral pores in our comparisons. References are listed below the table.

Character	Taxon (Specimen number)							
	<i>C. celatus</i> sp. nov. (BMNH 1926.10.30.45)	<i>C. darmandvillei</i> (ZMA 10943–44)	<i>C. gordongekkoi</i> (ZRC 2.3580–81)	<i>C. l. laevigatus</i> (FLMNH 28910–12)	<i>C. l. uniformis</i> (FLMNH 32597)	<i>C. wetariensis</i> (AMNH 32164–65)	<i>C. marmoratus</i> (RMNH 2710A)	<i>C. kimberleyensis</i> (WAM R164144)
Max. SVL	38	86	73	44	47	70	82	45
No. of supralabials	11	12	9–11	10–13	10–12	9–10	8–11	9–10
No. of infralabials	10	9–10	12	8–10	9–11	8–9	8–10	9–10
No. of longitudinal dorsal tubercle rows	16	18–20	18	18	18	14–16	16–19	16–18
Presence of tubercles on lateral skin fold	–	+	–	–	–	+	–	–
Presence of precloacal groove	–	–	–	–	–	–	+	–
No. of ventrals	42	36–40	30	30–33	32	38–40	38–47	36
No. of subdigital lamellae on 4th toe	17	20–22	19–21	13–15	14	17	20–24	15
Presence of enlarged median subcaudals	–	+	–	–	–	–	–	–
Reference	1–3	4	1,5	1	6		7	

1—Auffenberg 1980; 2—Brongersma 1934; 3—Weber 1890; 4—Das 1993; 5—Darevsky 1964; 6—Dunn 1927; 7—Bauer & Doughty 2012.

Discussion

A Note on Pholidosis. The discovery of this specimen led us to a comprehensive evaluation of scale characters for Lesser Sunda and extralimital *Cyrtodactylus*. The set of scale characteristics routinely listed for bent-toed geckos (i.e., numbers of supralabials, infralabials, dorsal tubercle rows, precloacal and femoral scales, subdigital lamellae) on occasion provide only narrow differences insufficient for defining species boundaries. There is often overlap in these characteristics between species, and while taken together they may make for a solid diagnosis, we feel

additional details in some characteristics may be helpful. To this end, we recommend three additional areas of pholidosis for a closer investigation: tubercle size vs. granule size at mid-dorsum, expansion of subcaudal scales, and careful examination of the chin shields, using both meristic and metric approaches. These characteristics are generally reported in detailed specimen descriptions, but for our differentiation of Lesser Sunda taxa we found the use of more nuanced definitions helpful. From evaluating these characteristics in Lesser Sunda species for which larger sample sizes are available ($N \geq 5$; e.g., *C. darmandvillei*, *C. laevigatus*, *C. wetariensis*), we have found that these data appear to show no greater intraspecific variation than the more traditionally used scale characteristics. Variations of 1–2 scales in all scale counts as well as minor variations in qualitative characteristics exist, and this is expected. It should be noted that these characteristics are not intended to be used in isolation, but are reported in addition to the set that is perhaps more of a standard in *Cyrtodactylus* taxonomy.

We noted that among Lesser Sunda taxa, the larger forms from the Inner Banda Arc (*C. darmandvillei*, *C. wetariensis*) have a notably more tuberculate appearance than the smaller forms (the subspecies of *C. laevigatus*, *C. gordongekkoi*). In order to allow objective statements regarding the quality of mid-dorsal “roughness,” we have been collecting information to quantify the size of tubercles and the way they are distributed across the mid-dorsum. Our data to assess tubercle condition includes an estimate of how many of the adjacent granular scales would fit into the area occupied by a tubercular scale. The second component of the “roughness” assessment is the spread of tubercles in terms of the number of granular scales between adjacent tubercles, both in side-to-side and back-to-front distribution.

There are several different types of enlarged subcaudal scales, but these are generally not differentiated further. A standard approach is to determine whether any of the subcaudals are enlarged, and the character state is then generally expressed as a presence vs. absence parameter. We have found some interesting differences in subcaudal scale anatomy, and a particular anatomy can, in our experience with Lesser Sunda species, be assigned in the absence of intraspecific variation. Whereas the area of the first post-pygal vertebrae is not suitable for identifying subcaudal scale character states due to observed irregularity, we have found that the area of the tail identified by extending the hind limbs backwards and lining them up against the tail is an appropriate place for determining the state of subcaudal scales. One character state is to have small rounded scales that form a tiled pattern. This is the pattern found in *C. gordongekkoi*, *C. marmoratus sensu stricto*, and *C. wetariensis*. A second pattern is one in which the scales are slightly expanded laterally, and there is slight overlap of the more anterior scales over the more posterior row of scales. This pattern is found in *C. celatus* and both subspecies of *C. laevigatus*. In contrast, *C. darmandvillei* from Flores (here singled out because it is the type locality of the species and there has been some speculation over whether this species is really a complex) has enlarged subcaudals. This manifests itself as scales that are as wide as the ventral surface of the tail, while remaining narrow in their length. In extralimital species, we have observed (1) enlarged subcaudals that contrast with the previous characteristics by being not only wide in a transverse direction but also longitudinally, (2) enlarged scales that only cover half of the width of the tail and are surrounded by smaller scales, (3) enlarged scales that are alternately longer and shorter while retaining a constant width across the tail, and (4) enlarged scales that form a subcaudal mosaic, interspersed with some smaller and some larger scales.

Our study of the chin shields (Fig. 6) has revealed similar complexity to the subcaudal scales. Chin shields have not been used as a diagnostic character in *Cyrtodactylus* because it has been assumed that these scales have too great an intraspecific variability to be useful in species diagnoses. Our experience with Lesser Sunda taxa shows that a very basic, descriptive approach to chin shields may indeed be unsuitable to delineate species, but there are several characters that provide some useful information. In terms of the advanced chin shield description, there is information in the width of the mental scale, the angle formed by the two grooves on either side of the mental scale, the length of the groove between the 1° postmentals, the area of the 1° postmentals, the number, size, and shape of 2° postmentals (Fig. 6A,B), the location on the 1st infralabial where 1° and 2° postmentals meet, the number of small gular scales surrounding the entire set of postmentals forward of the 3rd infralabials (i.e., the number of small scales that frame the enlarged postmentals, whether these are 2° or 3° postmentals), and whether the 1° postmentals reach the small gular scales. While we do not want to overemphasize the importance of the chin shields, they can in many cases, just as they do among house geckos (e.g., *Hemidactylus frenatus*, *H. garnotii*), provide a useful character for field identification.

***Cyrtodactylus* on Timor.** It is clear by the rapid rate at which new species of *Cyrtodactylus* are described (e.g., Heidrich *et al.* 2007; Oliver *et al.* 2009; Bauer *et al.* 2010; Chan & Norhayati 2010; Grismer *et al.* 2010, 2012a;

Bauer & Doughty 2012) that our understanding of their true biodiversity is still incomplete. The discovery of *Cyrtodactylus* in Timor, the southeasternmost island record in Asia, provides an opportunity to take a closer look at the diversity of bent-toed geckos in the Lesser Sunda Islands, of which Timor is the largest (30,777 km²). Recent survey work (Kaiser *et al.* 2011, 2013; O’Shea *et al.* 2012; Sanchez *et al.* 2012) has shown that the eastern half of Timor, within the borders of the sovereign nation of Timor-Leste, harbors at least four new species of *Cyrtodactylus*. Together with the recent description of *C. kimberleyensis* from northern Australia (Bauer & Doughty 2012), it therefore appears that, with five presumably endemic species, Timor may represent a regional center of *Cyrtodactylus* diversity, as well as a potential stepping-stone for the colonization of the northwestern regions of Australia. Some preliminary molecular work incorporating sequence data of specimens from several putative new species of *Cyrtodactylus* from Timor into a larger data set suggests that the biogeography of this archipelago does not conform to a simple dispersal pattern beginning on mainland Asia and progressing through the Indonesian Archipelago, but that there may have been several colonizations of *Cyrtodactylus* from mainland Asia and back in the opposite direction (Kathriner *et al.* in prep).

Cyrtodactylus celatus is described from a single specimen from Tjamplong, West Timor. Malcolm Smith recorded that the region was “well wooded, with numerous small streams” (Smith 1927:202), which is similar to habitat composition observed on other nearby Lesser Sunda Islands. For example, Flores (area 13,540 km²), an island less than half the size of Timor, falls within the distribution of *C. darmandvillei* and *C. laevigatus* (Zug & Kaiser 2014). Both these species have been recorded in tropical deciduous forest, under rotten trees during daylight hours or on tree stumps at night (Auffenberg 1980). Unfortunately, whereas Smith’s description of Tjamplong describes a woodland, recent Google Earth images of the type locality show a significantly degraded, barren habitat in which the native forest appears to have been removed and replaced by rice paddies and human habitations.

In light of the most recent reports on the herpetofauna of Timor (Kaiser *et al.* 2011; O’Shea *et al.* 2012; Sanchez *et al.* 2012), it is somewhat surprising that Smith stated that, “From a herpetological point of view, Timor is one of the most disappointing places that one can visit.” (Smith 1927:199). Claiming that “there is probably no other island [in the tropics] so barren in reptilian and batrachian life” (Smith 1927:200), we counter his observation by making note of the cryptic diversity in scincid and amphibian species collected during recent survey work (Kaiser *et al.* 2011; O’Shea *et al.* 2012). We conclude that the herpetological diversity on Timor, and in the Lesser Sundas in general, is still woefully underestimated due to the logistical difficulty with conducting fieldwork there. Because Timor is the largest of the Lesser Sundas it provides the most niche space, and thus it might be considered a logical place for the evolution of significant levels of lizard diversity, particularly for geckos and skinks. It appears that at the beginning of the 21st Century there still is plenty of opportunity in the Indonesian Archipelago to uncover new species, even through specimens that have hidden in a museum for nearly a century.

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