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A New Bent-toed Gecko (*Cyrtodactylus*: Squamata: Gekkonidae) from the Island of Tanahjampea, South Sulawesi, Indonesia

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Abstract

The recent description of *Cyrtodactylus tahuna* from Sangihe Island and descriptions of other new species from remote islands in the Indo-Australian Archipelago indicate the important role of oceanic dispersal and isolation in the evolution and diversification of the genus *Cyrtodactylus.* We provide another example involving Tanahjampea Island, a remote island 155 km south of the Southwestern Peninsula of Sulawesi, Indonesia. Here, we describe a new species on the basis of 11 specimens collected from that island. This new species is an intermediate sized *Cyrtodactylus* with a snout–vent length of up to 76.1 mm in adult males and 72.8 mm in females. It is easily distinguished from all recognized species occurring on Sulawesi as well as in the Moluccas and Lesser Sunda Islands by the following unique combination of characters: (1) brachium and antebrachium tuberculated, (2) ventrolateral folds with tubercles, (3) 20–23 irregularly aligned rows of keeled tubercles, (4) 31–34 paravertebral tubercles, (5) 29–34 ventral scales between ventrolateral folds, (6) no precloacal depression, (7) enlarged precloacofemoral scales in continuous series, (8) males with 20–24 precloacofemoral pores in wide Λ-shape, (9) enlarged post precloacal scales present, (10) 19–21 fourth toe subdigital lamellae, (11) enlarged transversely median subcaudals absent, (12) tail not prehensile, (13) tubercles extend along 71% of original tail length, and (14) the original tails reaching 147% of snout–vent length. We also provide an identification key to the bent toed gecko species that occur in the Wallacea region.

Key words: oceanic dispersal, isolation, evolution, diversification

Abstrak

Pertelaan terkini *Cyrtodactylus tahuna* dari pulau Sangihe dan bersama spesies yang dipertelakan dari pulau-pulau satelit atau pulau-pulaun kecil lainnya di wilayah gugus kepulauan Indo-Australia adalah cukup baik menunjukkan teori "pemisahan dan isolasi oleh lautan" dalam evolusi dan diversifikasi dalam marga *Cyrtodactylus.* Hal ini juga berlaku di pulau Tanahjampea, pulau satelit yang berjarak sekitar 155 km di selatan semenanjung barat daya pulau Sulawesi, Indonesia. Di sini, kami mempertelakan spesies baru berdasarkan sebelas spesimen yang dikoleksi dari pulau tersebut. Spesies baru ini merupakan kelompok marga *Cyrtodactylus* berukuran sedang, dengan ukuran panjang dari ujung moncong hingga membukanya kloaka mencapai 76.1 mm pada jantan dewasa dan 72.8 mm pada betina dewasa. Spesies baru ini dengan mudah dibedakan dari spesies lainnya yang terdapat di Sulawesi demikian pula di kepulauan Maluku dan Sunda Kecil berdasarkan kombinasi unik karakter: (1) pada lengan atas dan bawah terdapat struktur tubercular, (2) di sepanjang lipatan kulit ventrolateral terdapat struktur tuberkular, (3) 20–23 baris struktur tuberkular berlunas yang tersusun tak teratur antara lipatan ventrolateral di tengah tubuh, (4) 31–34 struktur tuberkular di sepanjang paravertebral, (5) 29–34 sisik perut di antara lipatan ventrolateral, (6) tidak terdapat cerukan prekloakal, (7) sisik besar prekloakal dan sisik besar femoral tersambung menerus, (8) jantan mempunyai lubang prekloakal dan femoral yang menyambung sebanyak 20–24 dalam formasi Λ lebar, (9) sisik besar postklokal hadir, (10) 19–21 lamela pada jari kaki nomor empat, (11) tidak terdapat sisik besar di tengah subkaudal, (12) ekor tidak prehensil, (13) keterdapatan struktur tuberkular mencapai 71% dari panjang ekor, dan (14) panjang ekor original mencapai 147% dari panjang tubuh. Kami juga menyajikan kunci identifikasi spesies marga *Cyrtodactylus* yang terdapat di wilayah Wallacea.

Key words: teori oceanic dispersal dan isolasi, evolusi, diversifikasi.

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Introduction

The genus *Cyrtodactylus* currently consists of 233 described species (Uetz *et al.* 2018). At present, eight *Cyrtodactylus* species are recognized from the Sulawesi biodiversity hotspot region; *Cyrtodactylus fumosus* (Müller, 1895) is restricted to North Sulawesi (Mecke *et al.* 2016b), *C. jellesmae* (Boulenger, 1897) is a Sulawesi endemic distributed widely across the island, *C. spinosus* Linkem, McGuire, Hayden, Setiadi, Bickford & Brown, 2008 is another Sulawesi endemic that is known only from the northwestern Central Core (described from Lore Lindu National Park and we recently collected one additional specimen from the adjacent Gunung Torompupu region of Central Sulawesi), *C. wallacei* Hayden, Brown, Gillespie, Setiadi, Linkem, Iskandar, Umilaela, Bickford, Riyanto, Mumpuni & McGuire, 2008 is a large species from Central Sulawesi and Kabaena Island, *C. batik* Iskandar, Rachmansah & Umilaela, 2011 is another large species known only from Mount Tompotika near the tip of Sulawesi's Eastern Peninsula, *C. hitchi* Riyanto, Kurniati & Engilis, 2016 is a medium sized bent-toed gecko known from Mekongga Mountains on Sulawesi's Southeast Peninsula, and *C. tahuna* Riyanto, Arida & Koch, 2018 was recently described from Sangihe island, a small island in the Sangir-Talaud Archipelago that is ~190 km north of the northern tip of Sulawesi.

In 2005, our field team surveyed on the remote island of Tanahjampea, an island east of Wallace's Line in the region known as Wallacea, at the interchange of the Asian and Australian biogeographic zones. Tanahjampea is a small island (172 km^2) in the Flores Sea situated ~150 km south of the southern of the tip of the Sulawesi mainland and about 120 km north of Flores Island of the Lesser Sundas Archipelago (Fig. 1). During our survey, we collected examples of an unusual *Cyrtodactylus* gecko species. Following the evolutionary/general lineage species concept (*see* de Queiroz 2007), we consider diagnosable, geographically isolated lineages to be distinct species (*see* McGuire *et al.* 2007, Vogel & van Rooijen 2008, and Koch *et al.* 2009). Because our specimens are both isolated and readily distinguishable from all congeners, both from Wallacea and elsewhere in the range of the genus, we herein describe them as a new species of *Cyrtodactylus* from the Sulawesi region.

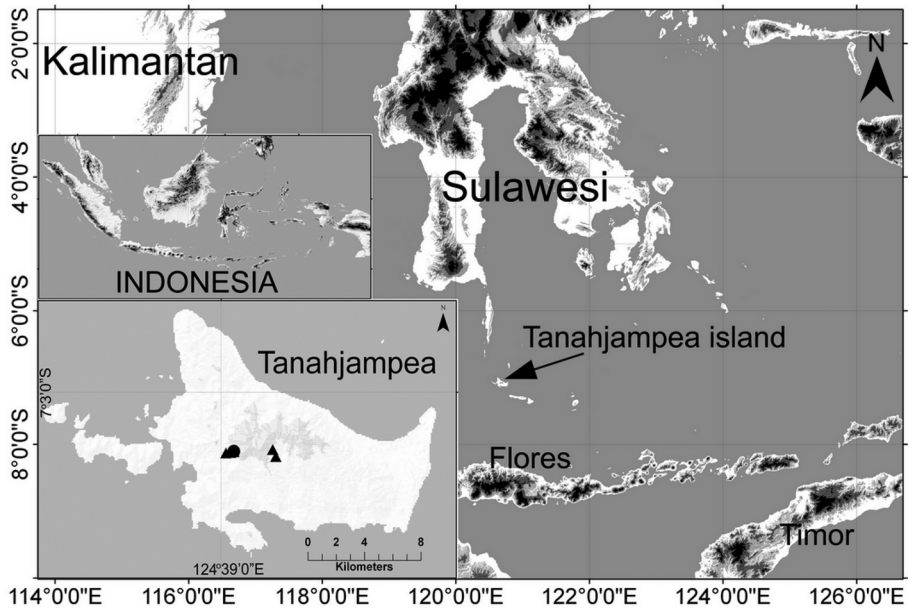

FIGURE 1. Map of Indonesia and Tanahjampea island showing distribution of *Cyrtodactylus tanahjapea* **sp.nov.** Black circle = holotype; Black triangle = paratypes.

It has been repeatedly demonstrated that remote islands in the Indo-Australian Archipelago have been colonized by *Cyrtodactylus* geckos via overwater dispersal giving rise to new species (*see* Youmans & Grismer 2006, Grismer *et al.* 2008a,b, Oliver *et al.* 2008, Oliver *et al.* 2009, Grismer *et al.* 2012, Riyanto 2012, Riyanto *et al.* 2015, and Riyanto *et al.* 2017a,b). The species that we describe herein provides yet another example of this important process that has contributed importantly in the assembly of the SE Asian *Cyrtodactylus* fauna.

Material and methods

The following measurements were taken with Mitutoyo dial calipers to the nearest 0.1 mm under an AmScope microscope. Measurements and scales counts were made on the right side of each specimen. To visualize some structures, such as subdigitals or pores, we used the reversible staining technique with methylene blue in 70% alcohol (Harvey *et al.* 2015). Sex was determined as male if (1) preserved specimens showed enlarged hemipenial pockets, and confirmed by (2) viewing the hemipenes via a small lateral incision made at the base of the tail. All measurements were made after specimens had been fixed in 10% buffered formalin and subsequently stored in 70% ethanol.

We measured snout-vent length (SVL, measured from tip of snout to vent), tail length (TailL, measured from vent to tip of tail), head length (HeadL, distance from tip of snout to posterior edge of retroarticular process of lower jaw), head width (HeadW, measured a straight line at angle of jaws), head depth (HeadD, maximum height of head between occiput and throat), snout length (SnoutL, measured from tip of snout to anterior most edge of orbit), eye to ear distance (EyeEar, measured from edge of orbit to anterior edge of ear opening), ear length (EarL, maximum length of ear opening), orbit diameter (OD, horizontal diameter of orbit, rostral width (RostW, distance between border of rostral shield and first supralabial scales on right and left sides), mental length (MentL, maximum length of mental shield), mental width (MentW, maximum width of mental shield), forearm length (ArmL, taken on dorsal surface posterior margin of elbow while flexed at 90° to inflection of dorsally flexed wrist), axilla groin length (AGL, measured from axilla to groin), tibia length (TibL, measured on ventral surface from posterior surface from posterior surface of knee while flexed at 90° to base of the heel).

For meristic data, we assessed the presence of tubercles on the dorsal surfaces of the brachium, antebrachium and thigh as well as the presence of enlarged transversely median subcaudals. While in assessing the morphology of subcaudal scales, we follow Kathriner *et al.* (2014), and follow Mecke *et al.* (2016) to describe the morphology of precloacal depressions. Further, we counted supralabial scales (SuL, counted from largest scale immediately posterior to dorsal inflection of posterior portion of upper jaw to the rostral scales), infralabial scales (InfL, number of labial scales of lower jaw, beginning with first scale bordering mental shield, ending with last enlarged scale bordering labial angle), enlarged precloacofemoral scales (PFS, number of enlarged precloacofemoral scales, counted along lowest, pore-bearing row), precloacofemoral pores (PFP, number of precloacofemoral pores), precloacal pores (PP, number of precloacal pores), femoral pores (FP, number of femoral pores), dorsal tubercles (DorsT, number of longitudinal tubercles rows on dorsum at midbody between ventrolateral folds), paravertebral tubercles (PVT, tubercle counted between postaxial margin of arm and preaxial of leg), ventral scales (VentS, number of ventral scales at midbody, counted in one row between ventrolateral folds), number of scales under fingers 1–5 ($LamF_{1-5}$, subdigital scales counted from point where interdigital skin contacts digit regardless of condition of scales under digit at this point, including fractured scales but not the elongate ungual scale at the base of the claw (claw sheath) or lamellae that extend onto the palm at base of digit), number of scales under toes 1–5 ($Lam\ T_{1-5}$, subdigital scales counted from point where interdigital skin contacts digit regardless of condition of scales under digit at this point, including fractured scales but not including the elongate ungual scale at the base of the claw or lamellae that extend onto plantar surface at the base of the digit). Basal subdigital scales were counted from the most proximal scale at least twice as large as adjacent palmar scales following Bauer *et al.* (2010).

Color notes were taken from digital images of living specimens prior to preservation. Latitude, longitude, and elevation of localities of specimens collected were recorded using a Garmin GPSmap 60CSx using WGS 84 map datum.

The holotype and a series of paratypes were deposited in Museum Zoologicum Bogoriense (MZB) Indonesia, while additional paratypes were deposited in the Museum of Vertebrate Zoology (MVZ) at the University of California, Berkeley, USA.

Results

Taxonomy

***Cyrtodactylus tanahjampea* sp. nov.**
English Common name: Tanahjampea bent-toed gecko
Indonesian name: Cicak Jari-lengkung Tanahjampea
Figs. 2–3

Holotype. MZB.Lace.5675 (Fig.2), adult male, Telkom tower road on Pasimasunggu district, Kepulauan Selayar regency, South Sulawesi Province, Tanahjampea Island, Indonesia (07°5'09.4" S, 120°39'29.2" E, 316 m above sea level) collected by J. A. McGuire, Christopher J. Hayden, and Ted Townsend on 18 October 2005, 9:07 pm.

Paratype. MZB.Lace.5671–72, MZB.Lace.5674, adult females, vicinity of Makminasa, Pasimasunggu district, Kepulauan Selayar regency, South Sulawesi Province, Tanahjampea Island, Indonesia (07º05'04.9" S, 120º40'58.3" E, 195 m above sea level), collected by Christopher J. Hayden on 16 October 2005 11:00 pm; MZB.Lace.5676, adult female, vicinity of Makminasa, Pasimasunggu district, Kepulauan Selayar regency, Sulawesi Selatan province, Tanahjampea Island, Indonesia (07º05'20.3" S, 120º41'05.4" E, 103 m above sea level), collected by J. A. McGuire on 16 October 2005, 10:10 pm; MVZ 267742, MVZ 267744 (Fig.3), adult females, vicinity of Makminasa, Pasimasunggu district, Kepulauan Selayar regency, Sulawesi Selatan province, Tanahjampea Island, Indonesia (07º05'04.9" S, 120º40'58.3" E, 195 m above sea level), collected by Christopher J. Hayden on October 2005, 11:00 pm; MVZ 267749–50, adult males, Telkom tower road, Pasimasunggu district, Kepulauan Selayar regency, Sulawesi Selatan province, Tanahjampea Island, Indonesia (07º05'09.4" S, 120º39'29.2" E, 316 m above sea level), collected by J. A. McGuire, Christopher J. Hayden, and Ted Townsend on 18 October 2005, 8:30 pm; MVZ 267752, adult female, Telkom tower road, Pasimasunggu district, Kepulauan Selayar regency, Sulawesi Selatan province, Indonesia (07º05'12.3" S, 120º39'11.1" E, 251 m above sea level), collected by J. A. McGuire, Christopher J. Hayden, and Ted Townsend on 18 October 2005, 9:07 pm.

Diagnosis. *Cyrtodactylus tanahjampea* **sp. nov.** is a medium size species reaching 76.1 mm and can be readily distinguished from the congeners on Sulawesi, the Moluccas, and the Lesser Sunda Islands by the following unique combination of characters: (1) brachium and antebrachium tuberculated, (2) ventrolateral folds with tubercles, (3) 20–23 irregularly aligned rows of keeled tubercles, (4) 31–34 paravertebral tubercles, (5) 29–34 ventral scales between ventrolateral folds, (6) no precloacal depression, (7) enlarged precloacofemoral scales in a continuous series, (8) males with 20–24 precloacofemoral pores in wide Λ-shape, (9) enlarged post precloacal scales present, (10) 19–21 fourth toe subdigital lamellae, (11) absence of enlarged transversely median subcaudals, (12) tail not prehensile, (13) tubercles extend over anterior about 71 % of original tail's length, and (14) the original tails reach 147 % of SVL.

Description of holotype. An adult male SVL 69.9 mm; head triangular in dorsal view (Fig.4A), distinct from neck; HeadL 32.6% of SVL, HeadW 63.0% of HeadL, HeadH 38.5% of HeadL and HeadH 11.0% of SVL; prefrontal region concave, canthus rostralis rounded (Fig.4B); SnoutL 38.8% of HeadL, OD 26.5% of HeadL, EarL 9.5% of HeadL and OD 93.0% of EyeEar. Scales on snout and forehead small, rounded, granular, homogeneous; scales on snout larger than those on occipital region. Pupil vertical, supraciliaries short and ear opening oval.

Rostral rectangular, height 37.9 % of width; incompletely divided dorsally by a Y-shaped shallow groove; bordered posterolaterally by first supralabials and naris, and dorsally by three postrostral scales (Fig. 4C); naris oval, bordered anteriorly by rostral, anterodorsally by one postrostral, posteriorly by five scales on right side and by six scales on left side, and ventrally by first supralabials; orbit separated from supralabials by single row of small lorilabial scales; 11 SuL on right and left side; 8 InfL on right and left side. Dorsal surface of head tuberculated, beginning between anterior margins of eyes, subpyramidal and gradually increasing in size toward the posterior margin of head that are subconical in form.

Mental triangular, length 89.7% of width; bordered laterally by first infralabials, posteriorly by one pair of enlarged first postmentals, which are in contact medially over 40.2% of their length; second postmentals smaller than first postmentals, hexagonal on right side and pentagonal on left side, with each about half the length of first postmentals, and separated from each other by three small granular scales (Fig.4D); gular scales small, granular, grading to slightly larger posteriorly.

Forelimbs relatively short, ArmL 20.0% of SVL; dorsal scales on forelimbs slightly larger than those of body, weakly keeled; dorsal surface of antebrachium with keeled tubercles, dorsal surface of brachium with few tubercles, multiple tubercles close to axilla becoming very few close to elbow; palmar scales flat, scales on palmar surfaces granular, juxtaposed; digits well-developed, inflected at basal interphalangeal joints, digits slightly narrower distal to inflection; subdigital scales transversely expanded along the entire length of each digit, but slightly compressed in both length and width immediately distal to interphalangeal inflection; 11 $LamF_1$, 14 $LamF_2$, 16 $LamF_3$, 17 $LamF_4$, and 15 $LamF_5$; claws well developed, sheathed by two dorsal scales and one ventral scale; relative length of fingers IV>III>V>II>I.

FIGURE 2. Holotype *Cyrtodactylus tanahjampea* **sp. nov.** (MZB.Lace.5675). Photo: A. Riyanto.

Hind limbs longer than forelimbs, TibL 16.0% of SVL; dorsal surface of thigh and tibia covered by granular scales interspersed with larger, conical tubercles; scales on ventral surface of thigh and tibia smooth, flat, and subimbricate; enlarged precloacofemoral scales in continuous series; no precloacal depression; 24 precloacofemoral pores in wide Λ-shape arrangement; 5 rows of enlarged postprecloacal scales (Fig.5A); plantar scales slightly raised, juxtaposed; digits well-developed, inflected at basal metapodial-phalangeal joints, digits slightly narrower distal to inflection; subdigital scales transversely expanded along the entire length of each digit, but slightly compressed in both length and width immediately distal to interphalangeal inflection; 12 $LamT_1$, 15 $LamT_2$, 18 $LamT_3$, 20 $LamT_4$, and 18 $LamT_5$; claws well-developed, sheathed by two dorsal scales and one ventral scale; relative length of toes IV>V> III> II> I.

Body elongate, AGL 44.9% of SVL; ventrolateral folds bearing small, scattered conical tubercles; ventral region with relatively homogeneous, smooth scales; dorsal scales small, granular, with scattered irregular, relatively enlarged keeled tubercles; 20 irregular rows of dorsal tubercles at midbody; 32 PVT; 33 VentS, much larger than dorsals, smooth, round, subimbricate, largest posteriorly.

Tail regenerated, TailL 75.8 mm with original part 30.8 mm and regenerated part 45 mm, subcylindrical, tapering to the tip; dorsal caudal scales flat, round, hexagonal, or pentagonal, and juxtaposed; large keeled tubercles present on lateral and dorsal surface of original part, lack on regenerated part; tubercles on caudals almost same size as tubercles on the dorsal surfaces of thighs and tibia, these tubercles almost twice larger than tubercle size on the dorsal surface of trunk; no enlarged transverse median subcaudals, on original part are small hexagonal

scales almost the same size while those on the regenerated part consist of a mixture between cycloid and rectangular subcaudals of various size; three postcloacal tubercles on each side of tail base.

FIGURE 3. Live photo of the paratype *Cyrtodactylus tanahjampea* **sp. nov.** (MVZ.267744). Photo: J A. McGuire.

Coloration in preservative. Head olive-brown dorsally, labials and ciliaries with a pattern of light and dark mottling; a broad olive-brown stripe from nostril to anterior eye; neck with a triangular, blackish-olive, darkly bordered spot; broad, olive-brown postocular stripe to neck; throat yellow.

Variation. The new species is sexually dimorphic with pores present in males that are lacking in females (Fig.5B). Four of the paratypes have original tails, and based on these it can be seen that caudal tubercles distally graduate to smaller size, disappearing at 71 % of the original tail length. For other detailed measurements and detailed character states for the entire type series see Table 1.

Etymology. The specific name *tanahjampea* refers to Tanahjampea Island, the only locality at which this species is known to occur.

Natural history. Specimens were collected at night in secondary forest (Fig.6) and selectively logged forest on a variety of natural microhabitats including on boulders/rock-faces adjacent to running and dry stream-beds, on large tree stumps, and on the trunks of large trees. Specimens were also collected on a concrete bridge foundation and on a concrete rock wall immediately adjacent to secondary forest.

Species comparisons. *Cyrtodactylus tanahjampea* **sp. nov.** can be readily distinguished from all recognized congeners occurring on Sulawesi, the Moluccas, and the Lesser Sunda Islands (detailed diagnostic characters for the species from these regions are presented in Table 2) except for *C. halmahericus* (Mertens, 1929) from which it differs by possessing EPFS, PP*, FP*, and in lacking enlarged median subcaudal scales on original tails (characters that are occur on males only are donated by *). The new species is easily differentiated from *C. halmahericus* by having strongly keeled dorsal tubercles (vs. keeled tubercles), fewer EPFS (40–45 vs. 48–53), precloacofemoral pores* (28–34 vs. 48–53) and in lacking a precloacal depression as opposed to having a deep precloacal groove. Further, it differs from *C. deveti* in its much smaller body size (76.1 vs. 106 mm SVL) and in lacking enlarged transverse median subcaudal scales (as opposed to presence of enlarged transverse median subcaudal scales). The new species is also easily distinguished from *C. nuaulu* by having EPFS as opposed to presence of EPS, PFP* as opposed to presence of PP*, and in males lacking a precloacal depression as opposed to having a deep precloacal

groove. Among the recognized species occurring in the Sulawesi region, *Cyrtodactylus tanahjampea* is similar to *C. fumosus* (data from Mecke *et al.* 2016b) in body size (< 80 mm SVL), in having of precloacofemoral pores in a continuous series, and in having a blotched dorsal pattern, but differs from that species in the presence of tubercles in the ventrolateral folds, in lacking a precloacal depression, in having more DorsT (20–23 *vs.* 4–7), and in having fewer VentS (28–34 vs. 37–50). Further, these species are also readily differentiated in the arrangement of their chin shields, with *C. tanahjampea* having paired elongated primary postmentals that contact medially for 50% of their posterior sections as opposed to having ~70% contact posteromedially in *C. fumosus*. The new species differs from *C. batik* (data from Iskandar *et al.* 2011; reexamine specimens *see* appendix 1) in being much smaller (76.1 vs. 114.6 mm), in having a blotched as opposed to a banded dorsal color pattern, in having fewer VentS (28–34 vs. 48–57), by the presence of EPFS (vs. lack of EPFS), PFP* (vs. poreless), and in lack enlarged transversely median subcaudal scales (as opposed to presence of enlarged transversely median subcaudals). The new species differs from *C. hitchi* in having tubercles on the dorsal surface of the brachium as opposed to the brachium untuberculated, EPFS as opposed to presence of EPS, PFP* as opposed to poreless both on precloacal and femoral, blotched as opposed to banded, and in lacking enlarged transverse median subcaudals as opposed to transversely median subcaudals arranged in a single row. *Cyrtodactylus tanahjampea* is further differentiated from *C. jellesmae* by having pores, EPFS, fewer VentS (28–34 vs. 40–50), and a blotched as opposed to striped dorsal pattern. It differs from *C. tahuna* in having EPFS and PFP* as opposed to a discontinuous series of EPS–EFS and a discontinuous series of PP*–FP*. From *C. spinosus*, the new species can be distinguished by its smaller body size (76.1 vs. 83.2 mm), its lack of spine-like tubercles scattered over the dorsum, in having PFP* and in lacking a precloacal depression. The new species differs from *C. wallacei* by its much smaller size (76.1 vs. 114 mm), by having PFP* as opposed to lacking pores, and in lacking enlarged transversely median subcaudal scales. The new species differs from all recognized species occuring in the Lesser Sundas in having a continuous series of precloacal and femoral pores in males. *Cyrtodactylus tanahjampea* differs from all species from this region except *C. darmandvillei* by having tubercles on the dorsal sufaces of the brachium. The new species can easily be distinguished from *C. celatus* (data from Kathriner *et al.* 2014, Rösler & Kaiser 2016, and Mecke *et al.* 2016a) by its much larger body size (76.1 vs. 38–44 mm), in having EPFS, in the absence of a precloacal depression as opposed to presence of a precloacal groove in males, and in having more lamellae under the fourth toe (18–23 vs. 15–18). From *C. darmandvillei* (data from Mecke *et al.*2016), the new species differs by lacking enlarged transverse median subcaudals as opposed to having enlarged transverse median subcaudals, and in having pores in males as opposed to being poreless in both sexes. From *C. gordongekkoi* (data from Das 1993, Biswas 2007, and Mecke *et al.* 2016a), the new species differs by the presence of tubercles on the dorsal surface of the brachium as opposed to absence and having precloacofemoral pores in males as opposed to being poreless in both sexes. From *C. laevigatus* (data from Kathriner *et al.* 2014 and Mecke *et al.* 2016a), the new species differs in its much larger body size (76.1 vs. 38.5 mm) and in having precloacofemoral pores in males as opposed to no pores in either sex. From *C. tambora*, the new species differs in its larger body size (76.1 vs. 39.4 mm), having precloacofemoral pores in males as opposed to presence of only precloacal pores in males, and in lacking a precloacal depression as opposed to presence of a precloacal groove in males. From *C. wetariensis* (Dunn, 1927) (data from Mecke *et al.* 2016a), the new species differs by having the brachium tuberculated as opposed to lacking tubercles on the dorsal surface of the brachium and by having precloacal pores and femoral pores arranged in a continuous series in males as opposed to being discontinuously arranged.

We also compare the new species to the other congeners occuring west and east of the Wallacea region. Enlarged precloacofemoral scales are present in *Cyrtodactylus tanahjampea*, whereas *C. boreoclivus* Oliver, Mumpuni, Krey & Richards, 2011, *C. consobrinus* (Peters, 1871), *C. elok* Dring, 1979, *C. ingeri* Hikida, 1990, *C. majulah* Grismer, Wood & Lim, 2012, *C. matsuii* Hikida, 1990, *C. pubisulcus* Inger, 1958, *C. quadrivirgatus* Taylor, 1962, *C. rosichonariefi* Riyanto, Grismer & Wood, 2015, *C. semiadii* Riyanto, Bauer & Yudha, 2014, *C. sermowaiensis* (De Rooij, 1915), and *C. yoshii* Hikida, 1990 lack such a series. The subcaudal scales are not transversely enlarged in *C. tanahjampea*, a condition that is shared with *C. klakahensis* Hartmann, Mecke, Kieckbusch, Mader & Kaiser, 2016, *C. loriae* (Boulenger, 1896), *C. marmoratus* Gray, 1831, *C. novaeguineae* (Schlegel, 1837), *C. petani* Riyanto, Grismer & Wood, 2015, *C. psarops* Harvey, O'Connell, Barraza, Riyanto, Kurniawan & Smith, 2015, *C. rosichonariefei* Riyanto, Grismer & Wood, 2015, *C. semiadii*, and *C. semicinctus* Harvey, O'Connell, Barraza, Riyanto, Kurniawan & Smith, 2015. In contrast, transversely enlarged subcaudals are present in *C. boreoclivus, C. brevipalmatus* (Smith, 1923), *C. consobrinus*, *C. hikidai* Riyanto, 2012, *C. ingeri* Hikida, 1990, *C. malayanus* (de Rooij, 1915), and *C. rex* Oliver, Richards, Mumpuni & Rösler, 2016.

TABLE 1. Morphometric characters of the type series of *Cyrtodactylus tanahjampea* **sp. nov.**

Museum Catalog Number	MZB.Lace.					MVZ				
	5675 Holotype	5671	5672	5674	5676	267742	267744	267749	267750	267752
Sex	Male	Female	Female	Female	Female	Female	Female	Male	Male	Female
Tuberculation on head	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Tuberculation on upper arm	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Tuberculation on lower arm	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Tuberculation on thigh	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Tuberculation on tibia	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
SuL (right/left)	11(11)	11(11)	10(10)	10(10)	8(8)	10(10)	8(9)	10(10)	10(10)	10(10)
InL (right/left)	8(8)	10 (10)	8(8)	9(9)	8(8)	8(9)	8(8)	9(9)	8(8)	9(8)
DorsT	20	18	18	18	18	21	22	23	21	20
PVT	32	33	31	32	31	34	33	33	32	34
VentS	33	32	34	34	31	32	29	30	30	28
Postcloacal tubercles at side of the base of tail	3right, 3 left	3 right, 4 left	3right, 3 left	3 left, 3 left	3right, 3 left					
Ventrolateral folds with tubercles	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
EPS	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
PFP	24	no	no	no	no	no	no	23	20	no
Precloacal groove	no	no	no	no	no	no	no	no	no	no
Enlarged postcloacal scales	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Enlarged transverse median subcaudal scales	no	no	no	no	no	no	no	no	no	no
Manus	4>3>2>1>5	4>3>2>1>5	4>3>2>1>5	4>3>2>1>5	4>3>2>1>5	4>3>5>2>1	4>3>5>2>1	4>3>5>2>1	4>3>5>2>1	4>3>5>2>1
Pes	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1	4>5>3>2>1
Lam F_1	11	13	12	12	12	15	14	15	13	14
Lam F_2	14	15	15	13	15	17	16	17	16	16

……continued on the next page

TABLE 1. (Continued)

Museum Catalog Number	MZB.Lace.					MVZ				
	5675 Holotype	5671	5672	5674	5676	267742	267744	267749	267750	267752
Lam F_3	16	17	17	17	17	18	17	20	18	17
Lam F_4	17	18	17	18	18	18	17	20	17	17
Lam F_5	15	15	15	15	16	16	15	17	16	17
Lam T_1	12	12	12	13	13	14	14	14	14	14
Lam T_2	15	16	15	16	16	17	16	18	16	16
Lam T_3	18	19	17	19	21	19	19	20	19	18
Lam T_4	20	20	19	19	21	21	21	22	20	20
Lam T_5	18	19	17	18	20	20	20	23	19	20
SVL	69.9	61.4	64.3	60.3	63.8	72.8	68.7	76.1	58.4	72.4
TL	75.8 regenerated	68 regenerated	77.5 regenerated	88.4	67.8 regenerated	83.2 regenerated	91.8	88.5 regenerated	79	91.4
TailL/SVL	n/a	n/a	n/a	1.47	n/a	n/a	1.34	n/a	1.35	1.26
HL/SVL	0.29	0.30	0.28	0.35	0.28	0.27	0.25	0.25	0.28	0.27
AGL/SVL	0.45	0.47	0.46	0.53	0.44	0.48	0.45	0.43	0.41	0.43
FL/SVL	0.20	0.19	0.19	0.22	0.19	0.14	0.15	0.16	0.16	0.15
TBL/SVL	0.16	0.16	0.15	0.15	0.15	0.16	0.18	0.19	0.18	0.18
HW/HL	0.63	0.31	0.61	0.58	0.63	0.63	0.72	0.69	0.63	0.65
HH/HL	0.39	0.34	0.36	0.37	0.40	0.40	0.45	0.43	0.42	0.38
ES/HL	0.30	0.26	0.26	0.24	0.26	0.32	0.31	0.33	0.30	0.29
ED/ES	0.89	0.98	1.00	0.81	1.04	0.82	1.07	0.87	0.94	1.00
ED/HL	0.27	0.26	0.26	0.20	0.27	0.26	0.34	0.28	0.28	0.29
Earl/HL	0.10	0.13	0.12	0.10	0.11	0.09	0.12	0.09	0.09	0.09
EE/ED	1.08	1.21	1.15	1.38	1.00	1.02	0.86	1.03	0.98	0.91

TABLE 2. Characters used to distinguish *Cyrtodactylus* species occurring on Sulawesi, the Moluccas, and the Lesser Sunda Islands. The presence of a diagnostic character is coded as '1', the absence of a character is coded as '0.' For taxa possessing precloacofemoral scales (= scales in a continuous series; column entitled '7'), precloacal- and femoral scales (separated from each other by infrascales) are coded as 'n/a' (columns entitled '5' and '6'). Numbers at the head of the table correspond to characters as follows: 1 = tubercles on upper arm (brachium), 2 = number of ventral scales, 3 = transversely enlarged median subcaudals in original tails, 4 = number of subdigital scales/lamellae under 4th toe, 5 = enlarged precloacal scales (the number of pores is given in parentheses and includes primordia; if pores are present in one sex only, this is indicated either by '♂' or '♀'), 6 = enlarged femoral scales (the number of pores is given in parentheses and includes primordia; if pores are present in one sex only, this is indicated either by '♂' or '♀'), 7 = enlarged precloacofemoral scales (the number of pores is given in parentheses and includes primordia; if pores are present in males only, this is indicated by '♂'), 8 = precloacal and femoral pores in a continuous series, 9 = expression of precloacal depression (N = no depression, G = groove, P = pit; if a depression is present in males only, this is indicated by '♂'), 10 = pattern of dorsum (bd = banded; bl = blotched; mo = mottled; pl = patternless; st = striped), 11 = data derived from literature sources are abbreviated by letters as follows: A = this publication, B = Riyanto *et al*. (2018), C = Riyanto *et al.* (2017), D = Mecke *et al.* (2016a), E = Mecke *et al*. (2016b), F = Riyanto *et al*. (2016), G = Rösler & Kaiser (2016), H = Kathriner *et al.* (2014), I = Iskandar *et al*. (2011), J = Oliver *et al.* (2009), K = Hayden *et al.* (2008) and L = Linkem *et al.* (2008). If data for a character are not available, this is indicated by a question mark (?).

Taxon	SVL of adults (mm)	1	2	3	4	5	6	7	8	9	10	11
tanahjampea **sp. nov.**	76.1	1	28–34	0	18–23	n/a	n/a	1 (28–34,♂)	1	N	bl	A
batik	103–113	1	48–57	1	24–27	1	0	0	0	N	bd	A, L
celatus	38−44	0	34–42	0	15–18	1 (4, ♂)	0	0	0	G (♂)	bl	D, G, H
darmandvillei	80–82	1	34–36	1	23−24	n/a	n/a	1	0	N	bl	D
deveti	101–106	0	40–49	1	25–28	n/a	n/a	1(29–31, ♂)	0	N	bd	A
fumosus	57–78	0	37–50	0	17–23	n/a (10–11, ♂)	n/a (3, ♂)	1	0	G (♂)	bl	E
gordongekkoi	71–73	0	30	0	22–23	n/a	n/a	1	0	N	bl	D
halmahericus	75–78	1	39–42	0	22	n/a	n/a	1 (48–53, ♂)	1	G (♂)	bl	A
hitchi	62–79	0	39–45	1	18–21	1	0	0	0	N	bd	F
jellesmae	58–70	0/1	40–54	0	16–23	1	0	0	0	N	bl	A, D
laevigatus	38–47	0	30–34	0	10–15	?	0/1	?	0	N	mo, pl	D, H
nuaulu	77–88	1	48–55	0	17–20	1 (6, ♂)	0	0	0	G (♂)	bl, st	J
spinosus	83	1	38–44	0	19–21	1 (12–13, ♂)	1	0	0	P (♂)	bd	A, I
tahuna	79	1	49–50	0	20–24	1 (14, ♂)	1 (5, ♂)	0	0	P (♂)	bl	B
tambora	39–47	0	40	0	16–17	n/a (5–6, ♂)	n/a	1	0	G (♂)	pl	C
wallacei	92–114	1	45–49	1	17–25	1	0	0	0	N	bd, bl	A, K
wetarisensis	58–67	0	36–38	0	20–22	n/a (11, ♂)	n/a (12–16, ♂)	1	0	N	bl	D

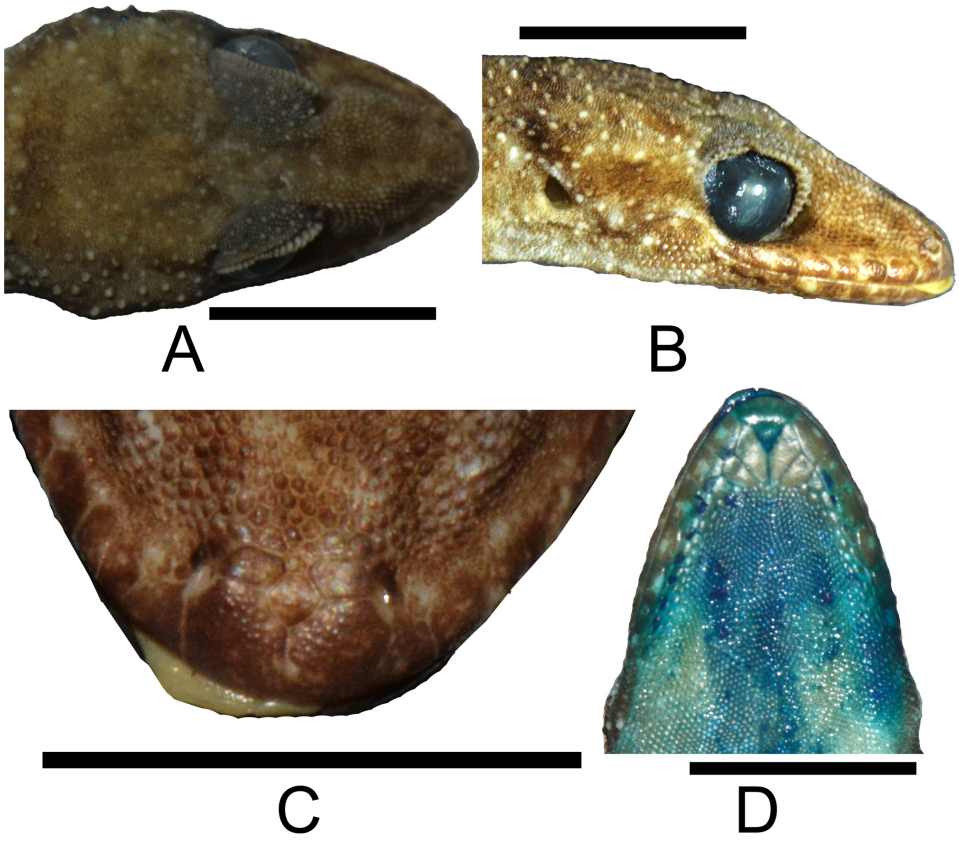

FIGURE 4. Detailed illustrations on head of the holotype of *Cyrtodactylus tanahjampea* **sp. nov.** (MZB.Lace.5675). (A) Above view of head. (B) Lateral view of head. (C) Snout region, showing rostral and post rostrals scales. (D) Ventral view of head. Bars = 10 mm. Photos by A. Riyanto

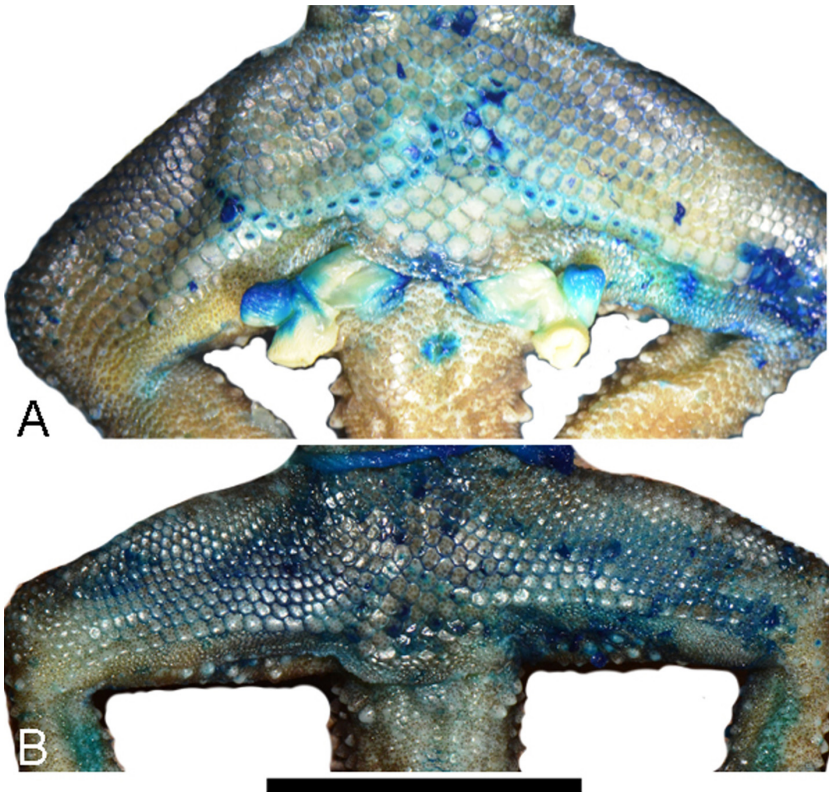

FIGURE 5. Comparation on femoral and cloacal region between male and female of *Cyrtodactylus tanahjampea* **sp.** (A) Male, holotype, MZB.Lace.5675, showing precloaccofemoral pores and lack precloacal depression. (B) Female, paratype, lack precloacofemoral pores and groove. Bar = 10 mm. Photos by A. Riyanto.

FIGURE 6. Habitat of *Cyrtodactylus tanahjampea* **sp. nov.** Photo by J. A. McGuire.

Discussion

Through a relatively small island of only 172 km², Tanahjampea is home to a surprising number of endemic species. Tanahjampea endemics include the snakes *Cylindrophis isolepis* Boulenger, 1896, *Trimeresurus fasciatus* (Boulenger, 1896), and *Boiga tanahjampeana* Orlov & Ryabov, 2002, and as well as an endemic bird (the Tanahjampea Blue-flycatcher, *Cyornis djampeanus* Hartert, 1896). Further, Bird Life International identified the

island as an Important Bird Area because it supports populations of the Critically Endangered Yellow-crested Cockatoo (*Cacatua sulphurea djampeana* Hartert, 1897) and Endangered White-tipped Monarch (*Symposiachrus evertti* Hartert, 1896). With the description of *Cyrtodactylus tanahjampea* **sp. nov.**, four reptile species are now known to be endemic to this island. Given its geographical position between Sulawesi and the Lesser Sunda Islands and its apparent high endemicity, Tanahjampea represents a biogeographically interesting island worthy of further taxonomic and biodiversity survey work.

Cyrtodactylus is one of the fastest growing species number in the vertebrate genera. Just since 2000, 159 new species have been described (of 233 total), most of which from the Greater Sunda Shelf. Although 18 species have been added to the Indonesian *Cyrtodactylus* fauna during this period thereby bringing the total for the country to 36, we believe that the scope of the Indonesian fauna remains greatly underestimated. Because Indonesia encompasses more than 16,000 named islands spread across three of the world's major biogeographical provinces, all of which are inhabited by *Cyrtodactylus* geckos, we anticipate that many new species of Indonesian *Cyrtodactylus* await discovery and description.

Identification Key to the species of the genus *Cyrtodactylus* of Wallacea Region

This key is applies to adult bent-toed geckos based on non-sexually dimorphic characteristics.

1a	Ventrolateral fold and lateral portion of tail with long spines; tail prehensile	*C. spinosus*
1b	No spines; tail not prehensile	2
2a	Enlarged subcaudal present	3
2b	Enlarged subcaudal absent	4
3a	Brachium tuberculated	5
3b	Brachium not tuberculated	6
4a	Enlarged precloacofemoral scales present	7
4b	Enlarged precloacofemoral scales absent	8
5a	Enlarged precloacofemoral scales present	*C. darmandvillei*
5b	Only enlarged precloacal scales	9
6a	Body robust, enlarged precloacofemoral scales present; males with precloacofemoral pores	*C. deveti*
6b	Body slender, enlarged precloacal scales present and poreless.	*C. hitchi*
7a	Brachium tuberculated	10
7b	Brachium not tuberculated	11
8a	Enlarged femoral scales present; males with femoral pores	*C. tahuna*
8b	Enlarged femoral scales absent	12
9a	Enlarged subcaudal in single row	*C. batik*
9b	Enlarged subcaudal in multiple rows	*C. wallacei*
10a	Dorsal tubercles strong keel raised; 28–34 ventral scales; 18–23 lamellae under fourth toes; enlarged precloacofemoral scales; males with 20–24 precloacofemoral pores and without precloacal depression	*C. tanahjampea*
10b	Dorsal tubercles keeled; 39–42 ventral scales; 48–53 enlarged precloacofemoral scales; males with 48–53 precloacofemoral pores and depth groove	*C. halmahericus*
11a	Infrascales present	13
11b	Infrascales absent	14
12a	Tubercles present on the ventrolateral folds	15
12b	Tubercles absent on the ventrolateral folds	16
13a	4–7 keeled dorsal tubercles	*C. fumosus*
13b	14–16 keeled dorsal tubercles	*C. wetariensis*
14a	SVL ≤ 50 mm; 40 ventral scales; 16–17 lamellae under fourth toes; males with 5–6 precloacal pores and precloacal groove	*C. tambora*
14b	SVL ≥ 70 mm; 30–32 ventral scales; 20–22 lamellae under fourth toes; males without pores and precloacal groove	*C. gordongekkoi*
15a	Lateral tubercles extending to the tip of tail; precloacal pores, precloacal groove and enlarged precloacal scales present in males	*C. nuaulu*
15b	Lateral tubercles not extending to the tip of tail; males lack of precloacal pores, precloacal groove and enlarged precloacal scales	*C. jellesmae*
16a	Enlarged precloacal scales present	*C. celatus*
16b	Enlarged precloacal scales absent	*C. laveigatus*

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APPENDIX 1. Material examined.

Cyrtodactylus batik. MZB.Lace.8511 (holotype), adult female, MZB.Lace.8512–13 (paratypes), juvenile female, MZB.Lace. 8514 (paratype), adult female, Bualemo, Mount Tompotika, Central Sulawesi, Indonesia.

Cyrtodactylus consobrinus: MZB.Lace.4355, MZB.Lace.8851–52 (males), Martabe, South Tapanuli, North Sumatra, Indonesia.

Cyrtodactylus deveti. MZB.Lace.7956, MZB.Lace.8164–65, adult males, Halmahera Island, Indonesia.

Cyrtodactylus halmahericus. MZB.Lace.6087, MZB.Lace.6091, MZB.Lace.13250, adult males, Halmahera Island, MZB.Lace.6089, adult female, Ternate Island, MZB.Lace.6090, adult female, Halmahera Island, Indonesia.

Cyrtodactylus hitchi. MZB.Lace.8642 (holotype), MZB.Lace.8635, MZB.Lace.8646, MZB.Lace.8648, adult males, MZB.Lace.8636, MZB.Lace.8640–41, MZB.Lace.8643–45, MZB.Lace.8647 (paratypes), adult females, Kolaka Utara, Mount Mekongga, Southeast Sulawesi, Indonesia.

Cyrtodactylus jellesmae. MZB.Lace.5126, adult male, MZB.Lace.5128, adult female, Salibabu Island, Indonesia.

Cyrtodactylus malayanus: MZB.Lace.2928-29 (males), Kalimantan Timur, MZB.Lace.8854–57 (males), Martabe, South Tapanuli, North Sumatra; MZB.Lace.2928–29 (males), Maruwai, East Kalimantan, Indonesia.

Cyrtodactylus nuaulu. MZB.Lace.2326 (holotype), adult male, Seram Island, Indonesia.

Cyrtodactylus spinosus: MZB.Lace (JAM15539) (female), Mount Toropupu, Central Sulawesi, Indonesia

Cyrtodactylus tambora. MZB.Lace.13298 (holotype), adult male, MZB.Lace.13296 (paratype), subadult male, MZB.Lace.13297, MZB.Lace.13909 (paratypes), adult females, Bima, Mount Tambora, West Nusa Tenggara, Sumbawa Island, Indonesia.