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A NEW BENT-TOED GECKO SPECIES OF THE GENUS *Cyrtodactylus* GRAY, 1827 (SQUAMATA: GEKKONIDAE) FROM THE WEST BALI NATIONAL PARK, BALI, INDONESIA

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A. A. Thasun Amarasinghe^{1,4}, Awal Riyanto², Mumpuni² & Lee L. Grismer³

¹ Research Center for Climate Change, University of Indonesia, Gd. PAU Lt. 8.5, Kampus UI, Depok 16424, Indonesia

² Museum Zoologicum Bogoriense (MZB), Research Center for Biology, Indonesian Institute of Sciences (LIPI), Jl. Raya Jakarta Bogor Km. 46 Cibinong West Java Indonesia 16911

³ Department of Biology, La Sierra University, 4500 Riverwalk Parkway, Riverside, California 92515, USA

⁴ Association of Asian Herpetology (Asosiasi Herpetologi Asia), Jl. BSD Bintaro No. 88, Pondok Aren 15228, Tangerang Selatan, Indonesia

¹ Corresponding author. E-mail: thasun@rccc.ui.ac.id

Abstract

A new bent-toed gecko species of the genus *Cyrtodactylus* is described herein from West Bali National Park on the island of Bali, Indonesia. The *Cyrtodactylus* from Bali have been recognized as *C. fumosus* for nearly a century. However, recent detailed examination of the type material of *C. fumosus* has revealed that Balinese *Cyrtodactylus* represent at least one different species. A morphological examination of the new species and samples from different biogeographic regions revealed that the new species is similar to *C. seribuatensis* from Pulau Seribuat in West Malaysia. Morphologically, the new species can be distinguished from its congener by having 40–43 femoro-precloacal pores (vs 10–12 precloacal pores, 14–16 femoral pores), 40–48 ventral scales between ventrolateral folds (vs 28–39), 24–29 rows of dorsal tubercles (vs 27–35), and presence of tubercles on lateral skinfold (vs absent).

Key words: *Cyrtodactylus fumosus*, Sundaland, taxonomy, Taman Nasional Bali Barat

Introduction

The island of Bali, or Pulau Dewata in Indonesian, is one of world's most popular tourist destinations with one of the region's richest cultural histories. Its importance to biogeography and biodiversity has been known ever since Alfred Russel Wallace documented a faunal shift when crossing the Lombok Strait

from Bali to neighboring Lombok (Wallace 1868), a distance of only 35 km. In Wallace's honor, the imaginary line separating these islands and their faunas was named Wallace's Line (Huxley 1868; Barbour 1912), and the biogeographic region that extends east beyond Bali into the Indonesian island archipelago has become known as Wallacea (Beccaloni 2015,

Marzuki & Andili 2015). However, with the development of tourism and Bali's standing as a staging ground for expeditions to outlying areas, Bali itself has been somewhat overlooked as an island with potentially high diversity and endemism. Bali Island (5,780 km²) is geologically part of a volcanic island arc that includes the Greater and Lesser Sunda Islands. The main, northern portion of the island was created over a period of time by the eruptions of undersea volcanoes, and it probably surfaced about 3 million years ago (McKay 2006). Bali's fauna and flora are generally most closely allied with that of neighboring Java. Java is a much larger island (128,297 km²) formed by an east-west series of volcanoes and sedimentary accretions, and separated from Bali only by the narrow (3 km) Bali Strait (Whitten *et al.* 1996). Based on Bathymetric Map number 290 at a scale of 1:200,000, edition of March 2006, the Bali Strait is shallow in its narrowest part with an average depth of about 50 m, and deeper at its northern and southern ends where depths range from 100 to 800 m (Berlianty & Yanagi 2011). The herpetofauna of Bali is under the influence of the humid climate of Southeast Asia and the Greater Sunda Islands, and the generally drier weather patterns along the Lesser Sunda chain. It has been suggested that for some species, the genetic difference between the Balinese populations and those of the Greater Sundas may indicate that the populations on Bali have been isolated for a substantially long period of time, although, the sea passage between East Java and Bali is narrow and should not hinder species migration (Amarasinghe *et al.* 2017). The most recent herpetofaunal checklists of Bali (e.g. McKay 2006, Riyanto & Mumpuni 2013) include only one species of bent-toed gecko, *Cyrtodactylus fumosus* (Müller, 1895). Recent investigations into the taxonomy of *Cyrtodactylus* in Indonesia (Hartmann *et al.* 2016, Harvey *et al.* 2015, Riyanto *et al.* 2015a,b, 2016, 2017, 2018a,b) documented evidence that the *Cyrtodactylus* fauna is probably far more diverse than the current species counts would indicate. A detailed re-examination of *C. fumosus* s. str. by Mecke *et al.* (2016a) revealed that our specimens from Bali represent an unnamed species, which we here regard as a valid new species of the genus *Cyrtodactylus*.

Materials and methods

We collected the type series by hand, euthanized the specimens with sodium pentobarbital or

trichloromethane, and fixed the specimens in 10% buffered formalin prior to storage in 70% ethanol. We preserved tissue samples for DNA analysis in 96% ethanol. We compared specimens of the new species to specimens and original descriptions of close congeners. Museum acronyms are those of Uetz *et al.* (2019). Specimens of the new species were examined at the Museum of Zoology, Research Center for Climate Change, University of Indonesia (UIMZ) and are currently deposited at Museum Zoologicum Bogoriense, Cibinong, Indonesia (MZB). Measurements and scale counts were made on the right side of each specimen. To visualize some structures, such as subdigital lamellae or pores, we used the reversible staining technique with methylene blue in 70% alcohol (Amarasinghe *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. Under an AmScope / Leica Wild M3Z dissecting microscope, with a Mitutoyo digital caliper to the nearest 0.1 mm, we measured snout-vent length (SVL, measured from tip of snout to vent), tail length (TL, measured from vent to tip of tail), head length (HL, distance from tip of snout to posterior edge of retroarticular process of lower jaw), head width (HW, measured a straight line at angle of jaws), head depth (HD, maximum height of head between occiput and throat), snout length (ES, measured from tip of snout to anterior most edge of orbit), eye-nostril length (EN, from anterior border of orbit to posterior border of nostril), tympanum-eye length (TYE, measured from edge of orbit to anterior edge of ear opening), tympanum diameter (TYD, maximum length of ear opening), orbit diameter (OD, horizontal diameter of orbit), forearm length (FAL, taken on dorsal surface from posterior margin of elbow while flexed at 90° to inflection of dorsally flexed wrist), femur length (FEL, from the anterior margin of the hind limb at its insertion point on the body to the knee while flexed), and tibia length (TBL, measured on ventral surface from posterior surface from posterior surface of knee while flexed at 90° to base of the heel).

Further, under an AmScope microscope or a Leica Wild M3Z dissecting microscope we

counted supralabial scales (from largest scale immediately posterior to dorsal inflection of posterior portion of upper jaw to the rostral scales), infralabial scales (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 (number of enlarged precloacofemoral scales along lowest pore-bearing row), dorsal tubercles (number of longitudinal tubercles rows on dorsum at midbody between ventrolateral folds), paravertebral tubercles (tubercles between postaxial margin of arm and preaxial margin of leg), ventral scales (number of ventral scales at midbody in one row between ventrolateral folds), number of scales under fingers/toes 1–5 [subdigital scales 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/ plantar surface at base of 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).

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. We follow Kathriner *et al.* (2014) and Mecke *et al.* (2016a,b) to describe the morphology of precloacal depressions. 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.

Taxonomy

Cyrtodactylus jatnai sp. nov.

(Figs. 1–4, Tables 1–3)

Cyrtodactylus fumosus—McKay 2006: 60

C. fumosus—Riyanto & Mumpuni 2013: 6

Holotype. Adult male, MZB uncat. (UIMZ 0085), SVL 66.8 mm, collected from Teluk Menjangan, Taman Nasional Bali Barat, Bali, Indonesia (08°08'38.6"S, 114°32'22.5"; 20 m a.s.l.), by A.A. Thasun Amarasinghe, on 26–27 August 2015.

Paratypes (n=18). Adult male, MZB uncat. (UIMZ 0082); adult female, MZB uncat. (UIMZ 0084); subadult male, MZB uncat. (UIMZ

0083); collected from Mt. Lannyng, Taman Nasional Bali Barat, Bali, Indonesia, other details same as holotype; adult male, MZB uncat. (UIMZ 0101); subadult males, MZB uncat. (UIMZ 0093, 0102); collected from Teluk Brumbun, Taman Nasional Bali Barat, Bali, Indonesia, other details same as holotype; adult males, MZB 8729, 8731; adult female MZB 8728; subadult males (MZB 8730, 8732, 8735); subadult females (MZB 8727, 8733, 8734); collected from Teluk Terima, Taman Nasional Bali Barat, Bali, Indonesia, by A. Riyanto, Mumpuni & Mulyadi on 11–15 April 2012; adult male (MZB 8726); adult female (MZB 8725); collected from Gerojogan, Taman Nasional Bali Barat, Bali, Indonesia, other details same as above; adult female (MZB 8737) collected from Teluk Menjangan, Taman Nasional Bali Barat, Bali, Indonesia, other details same as above.

Diagnosis. A combination of the following characters distinguishes the new species from all other Southeast Asian congeners: adult males reaching 66.8 mm SVL and females 64.8 mm SVL; 9–11 supralabials; 8 or 9 infralabials; strongly tuberculated body and limbs, lateral fold with tubercles, tubercles on anterior portion of tail; tubercles extend from occiput to waist, and becoming larger tubercles posteriorly; 24–29 dorsal tubercle rows; 40–48 rows of smooth ventrals; distinctly enlarged femoral scales in two rows, extending to precloacal region; 40–43 continuous femoro-precloacal pores in males; six rows of enlarged post precloacal scales; 17–19 subdigital lamellae on the fourth toe; no enlarged median subcaudals; no reticulated pattern on head; paired dark blotches forming a V-shaped on occiput; dorsum blotched.

Description of holotype. Adult male, SVL 66.8 mm, TL 82.5 mm; head triangular, moderately long (HL/SVL 0.29) and wide (HW/HL 0.63), somewhat depressed (HD/HL 0.39), distinct from neck; lores weakly inflated, prefrontal region concave, canthus rostralis smoothly rounded; snout short (ES/HL 0.39) and rounded; eye large (OD/HL 0.32); ear opening oblong, small (TYD/HL 0.09); eye–ear length greater than diameter of eye (TYE/OD 0.70); rostral 1.6 times wider (2.2 mm) than deep (1.4 mm), incompletely divided dorsally by a median Y-shaped rostral groove, bordered posterodorsally by three granules, of which the central scale bears a suture; nostril bordered anteriorly by

rostral, dorsally by one anterior supranasal, posteriorly by three nasals, and ventrally by first supralabials.

Supralabials, nine (both sides); eight infralabials (both sides), first three largest; scales of rostrum, lores, crown, and occiput small and granular, occiput with few small tubercles; mental triangular, as wide (2.3 mm) as deep (2.2 mm), bordered anterolaterally by first infralabials and posteriorly by paired elongate primary postmentals that contact posteriomediaally for 40% of their length; postmentals bordered by two enlarged chin shields and five small gular scales, the chin shields arranged in one row grading posteriorly into smaller scales and extending posteriorly to the sixth infralabial; gular scales small and granular, grading posteriorly into slightly larger, flatter, throat scales, then into large, flat, imbricate pectoral and abdominal scales.

Body relatively short (AGL/SVL 0.18) with weak ventrolateral folds bearing scattered tubercles; dorsal scales small, granular, interspersed with relatively high, trihedral, rounded tubercles that are arranged in 18 irregular rows at midbody; smallest tubercles on flanks and in the frontal region; 29 paravertebral tubercles at midbody; ventral scales much larger than dorsal scales; 42 flat, imbricate ventral scales at midbody between ventrolateral folds; precloacal region with six rows of enlarged scales; 43 femoro-precloacal pores in continuous row; two rows of enlarged femoral scales anterior to pores, twice larger than the next

anterior, then becoming slightly smaller in more anterior rows .

Forelimbs short (FAL/SVL 0.15); granular scales of forearms similar those of body; a few tubercles on dorsal base of lower arm; palmar scales slightly raised, smaller anteriorly than posteriorly; digits short, with inflection at basal inter-phalangeal joints; subdigital lamellae transversely expanded proximal to joint inflections, digits narrow distal to joints; claws well-developed, sheathed by a dorsal and ventral scale; subdigital lamellae on digits of manus: I (12), II (13), III (15), IV (15), V (13), relative lengths of manual digits: IV > V > III > II > I.

Hind limbs more robust than forelimbs, tibia relatively long (TBL/SVL 0.20), covered dorsally with granular scales interspersed with tubercles; ventral hind limb scales flat, larger than dorsal; digits short, subdigital lamellae of pes transversely expanded proximal to inflected joints, digits narrow distal to joints; count of subdigital lamellae on pes: I (12), II (14), III (16), IV (19), V (16), relative length of pedal digits: IV > V > III > II > I; claws well-developed, sheathed by a dorsal and ventral scale.

Tail original and complete, TL/SVL 1.23, robust at base, tapering to a point; dorsal caudal scales granular with six small tubercles on anterior caudal whorls; four post-cloacal tubercles on each side of vent; subcaudals small, flat, imbricate, smooth, and rounded, lacking enlarged median subcaudals.

Variation. Males have femoro-precloacal pores, while females do not. See Table 1 & 2.

Table 1. Morphometric characters of the type series of *Cyrtodactylus jatnai* sp. nov., measurements are in mm.

Character	holotype	paratypes (n=18)			
	Adult male	male		female	
		Adult (n=5)	Subadult (n=6)	Adult (n=4)	Subadult (n=3)
snout-vent length (SVL)	66.8	56.3–60.1	47.5–52.4	55.8–64.8	44.2–51.5
head length (HL)	19.5	16.2–18.2	14.0–15.8	15.3–20.6	14.0–15.4
head width (HW)	12.3	11.1–13.8	9.3–10.2	10.7–11.9	9.0–10.7
head depth (HD)	7.7	7.3–8.4	5.6–6.2	6.8–8.2	5.8–6.5
snout length (ES)	7.7	5.9–7.2	5.8–5.9	6.4–7.7	5.7–6
eye-nostril length (EN)	5.5	4.1–5.3	4.1–4.6	4.9–5.9	4.0–4.8
orbit diameter (OD)	6.3	4.2–6.3	3.2–4.6	4.2–6.5	3.2–4.1
eye to ear distance (TYE)	4.9	4.1–5.6	3.6–3.9	3.8–5.5	3.9–4.4
tympanum diameter (TYD)	2.3	2.0–2.3	1.3–1.6	1.3–1.9	1.5–1.7
forearm length (FAL)	9.9	9.0–10.0	7.2–8.1	8.7–10.0	6.8–7.9
femur length (FEL)	12.2	11.0–11.8	9.3–11.0	10.5–12.2	9.1–10.0
tibia length (TBL)	12.1	10.8–11.4	9.1–10.6	10.2–12.0	8.9–9.7
tail length (TL)	82.5	60.6–82.5	61.4–67.8	58.8–72.3	43.3–53.7

Plate 22

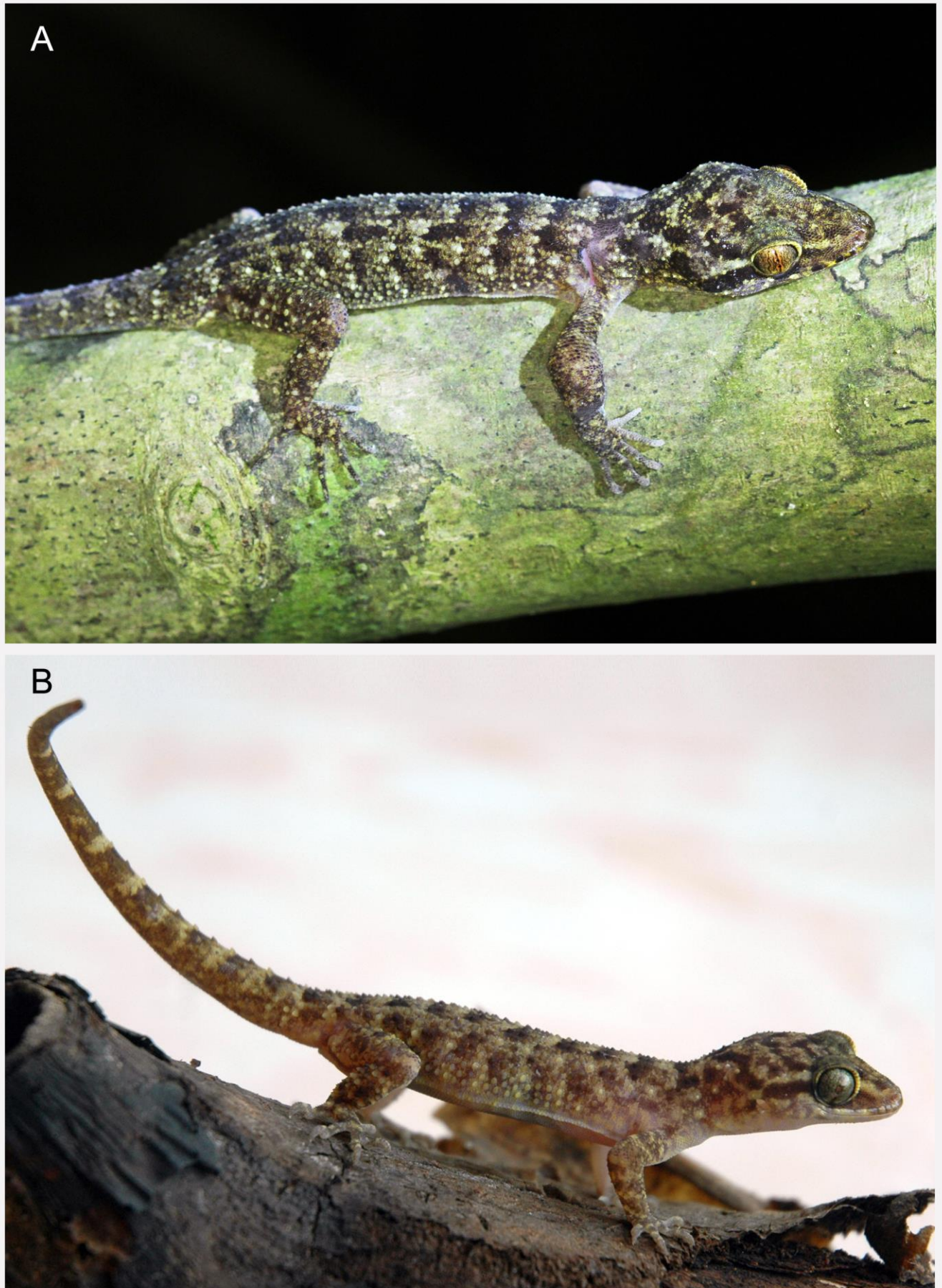


Figure 1. *Cyrtodactylus jatnai* sp. nov. **(A)** adult male (holotype, UIMZ 0085) from Teluk Menjangan, Taman Nasional Bali Barat, Indonesia. Photograph © A.A. Thasun Amarasinghe; **(B)** adult male (paratype, MZB 8729) from Teluk Terima, Taman Nasional Bali Barat, Indonesia. Photograph © Awal Riyanto.

Plate 23

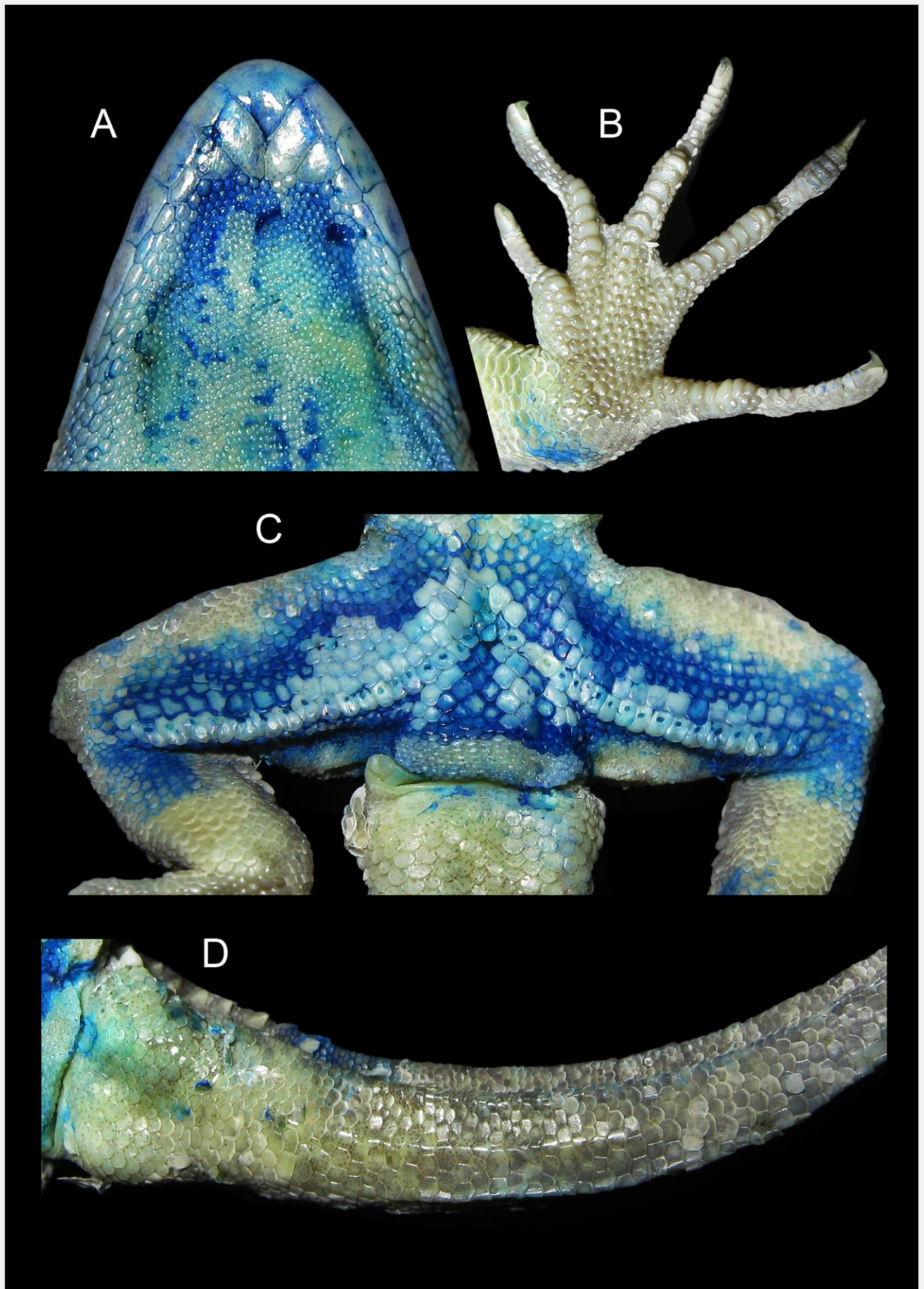


Figure 2. *Cyrtodactylus jatnai* sp. nov., paratype (MZB 8729), ventral aspect of the (A) anterior head, (B) foot, (C) femur, and (D) tail. Photograph © A.A. Thasun Amarasinghe.

Table 2. Meristic characters of the type series of *Cyrtodactylus jatnai* sp. nov.

Character	holotype	paratypes (n=18)			
	Adult male	male		female	
		Adult (n=5)	Subadult (n=6)	Adult (n=4)	Subadult (n=3)
Supralabials (Right / Left)	9 / 9	9 / 9	9 / 9,10	9,10 / 9,10	9,11 / 9,10
Infralabials (Right / Left)	8 / 8	8 / 8	8,9 / 8,9	7,8 / 7,8	8,9 / 8
Dorsal tubercle rows	18	17, 18	18, 19	17, 18	18
Paravertebral tubercles	29	24–26	27–29	24–28	26–29
Ventral scales between ventrolateral folds	42	44–46	40–44	40–48	40–45
Postcloacal spur	4	3, 4	3, 4	3, 4	3
Lamella on finger IV	16	15, 16	15, 16	15, 16	15–17
Lamella on toe IV	19	17–19	17–19	17,18	17–19
Enlarged femoro–precloacal scales	43	40–44	38–43	38–42	40–43
Femoro–precloacal pores	43	40–43	40–43	0	0

Coloration in life. Dorsum yellowish brown with dark blotches; eight pairs of dark square blotches on the trunk; paired dark blotches form a V-shaped marking on occiput; a dark line extends from posterior margin of nares to the anterior supracliliaris, interrupted by eyes, then continues to the ear opening and is interrupted by yellowish blotches above the ear; labials greyish bearing yellow and brown blotches; paravertebral blotches extend from nape to base of the tail; dark body blotches extend to tail where light countershading transforms into cream-colored bands which do not encircle the tail, 16 dark bands on the tail; tubercles on lateral fold and two or three series of tubercles adjacent lateral folds are yellowish. Venter white stippled with gray; subcaudals darkened with fine mottling; iris golden in color.

Etymology. The specific epithet is a noun in the genitive singular case, honoring a leading conservationist, ecologist, and primatologist Prof. Jatna Supriatna (University of Indonesia) for his enormous contributions to biodiversity conservation in Indonesia, as well as his generous friendship and support of the first author. Prof. Supriatna was born on Bali where the new species was discovered. His valuable contributions to science, policy making, and conservation management, as well as to popularizing the conservation ethic among his students and the general public are highly commendable. He is a legend in the field of conservation and locally he is known as “The Noah of Modern History”. The NGO, Conservation International, has called him “the Conservation Warrior of Indonesia”. English Name: Jatna’s bent-toed gecko.

Natural history. Specimens were collected during day and night in a variety of habitat types such as wet tropical and monsoon forests,

dry deciduous forests, coral outcrops near the beach, rock boulders near rivers, and shrubs near the beach (Fig. 3) at 20–130 m a.s.l. All were observed below 3 m above the ground level. The holotype was collected at 19:00 h while on a tree trunk 50 cm above ground level, near the beach.

Comparison. *Cyrtodactylus jatnai* sp. nov. is most similar to the following species: *C. batucolus* Grismer, Chan, Grismer *et al.*, 2008; *C. darmandvillei* (Weber, 1890); *C. jellesmae* (Boulenger, 1897); *C. kimberleyensis* Bauer & Doughty, 2012; *C. petani* Riyanto, Grismer & Wood, 2015a; *C. sadleiri* (Wells & Wellington, 1985); and *C. seribuatensis* Youmans & Grismer, 2006. However, the new species differs from them by characters listed in Table 3.

In addition, among the other similar species, the new species is distinguished from *Cyrtodactylus metropolis* Grismer, Wood, Onn *et al.*, 2014, by having 24–29 paravertebral tubercles (*vs* 32–34), 17–19 lamellae on the fourth toe (*vs* 20–21), and femoro–precloacal pores (*vs* poreless) in males; from *C. majulah* Grismer, Wood & Lim, 2012 by having 24–29 paravertebral tubercles (*vs* 39–46), and 40–43 femoro–precloacal pores (*vs* no femoral pores and 7–11 precloacal pores) in males; from *C. pantiensis* Grismer, Chan, Grismer *et al.*, 2008 and *C. payacola* Johnson, Quah, Anuar *et al.*, 2012 together by having 40–43 femoro–precloacal pores (*vs* no femoral pores and 8–12 precloacal pores) in males; from *C. psarops* Harvey, O’Connell, Barraza *et al.*, 2015 and *C. semicinctus* Harvey, O’Connell, Barraza *et al.*, 2015 together by having 40–43 femoro–precloacal pores (*vs* 28–38) in males; from *C. rosichonariefi* (*sic*) Riyanto, Grismer & Wood, 2015a by having 40–43 femoro–precloacal pores (*vs* poreless) in males; from *C. semenanjungensis* Grismer & Leong, 2005 by

having 24–29 paravertebral tubercles (*vs* 32–37), blotched dorsal color pattern (*vs* banded), and femoro-precloacal pores (*vs* poreless) in males; from *C. tiomanensis* Das & Lim, 2000 by having 40–48 ventral scale rows (*vs* 36–40), 17–19 lamellae on the fourth toe (*vs* 20–22), and 40–43 femoro-precloacal pores (*vs* 3–5 precloacal pores).

Furthermore, we compared the new species to the recognized Melanesian and Wallacean species. The new species is easily distinguished from *C. agamensis* (Bleeker, 1860) by having 40–48 ventral scale rows (*vs* 67), and 17–19 lamellae on the fourth toe (*vs* 26); from *C. batik* Iskandar, Rachmansah & Umilaela, 2011 by a much smaller SVL 66.8 mm (*vs* 110 mm) and by having 40–48 ventral scale rows (*vs* 48–57),

blotched dorsal color pattern (*vs* banded), and 40–43 femoro-precloacal pores (*vs* poreless) in males; from *C. baluensis* (Mocuard, 1890) by lacking enlarged transverse median subcaudals (*vs* enlarged) and by having 40–43 femoro-precloacal pores (*vs* 9–11 femoral pores and 4–10 precloacal pores) in males; from *C. cavernicolus* Inger & King, 1961 by having 40–48 ventral scale rows (*vs* 51–58), 17–19 lamellae on the fourth toe (*vs* 22–26), blotched dorsal color pattern (*vs* banded), and 40–43 femoro-precloacal pores (*vs* no femoral pores and 4 precloacal pores) in males; from *C. celatus* Kathriner, Bauer, O’Shea *et al.*, 2014 in being much larger SVL 66.8 mm (*vs* 38.4 mm) and by having 24–29 paravertebral tubercles (*vs*

Table 3. Selected diagnostic characters separating *Cyrtodactylus jatnai* sp. nov. from the species of the *Cyrtodactylus darmandvillei* complex; “—” not applicable, “?” unknown.

Charcter	<i>jatnai</i> sp. nov.	<i>batucolus</i>	<i>darmandvillei</i>	<i>jellesmae</i>	<i>kimberleyensis</i>	<i>petani</i>	<i>sadleiri</i>	<i>seribuatensis</i>
Maximum SVL (in mm)	66.8	75.2	75.0	63.0	45.0	57.2	88.0	75.0
Supralabials	9–11	9–11	12	10–12	9, 10	9, 10	9–13	8–13
Infralabials	8, 9	9–11	9, 10	10, 11	9, 10	7, 8	8–10	7–10
Tubercles on head	yes	yes	yes	yes	no	yes	yes	yes
No. of paravertebral tubercles	24–29	30–35	?	?	?	20–25	22–25	29–35
Tubercles on lateral skin fold	yes	?	yes	no	yes	no	no	no
No. of ventral scale rows	40–48	38–45	36–40	40–45	36	30–35	34–42	28–39
Deep precloacal groove	no	no	no	no	no	no	yes	no
No. of precloacal pores	—	—	?	0	?	—	8–13	10–12
Enlarged precloacal scales	—	—	?	?	?	—	yes	yes
No. of femoral pores	—	—	?	0	?	—	9–16	14–16
Enlarged femoral scales	—	—	?	?	?	—	yes	yes
No. of femorocloacal pores	40–43	43–46	?	—	?	31–35	—	—
Enlarged femorocloacal scales	yes	yes	?	—	?	yes	—	—
Tubercles on forelimbs	no	yes	yes	yes	no	yes	yes	yes
Tubercles on hind limbs	yes	yes	yes	yes	no	yes	yes	yes
4 th toe lamellae	17–19	17–19	?	?	16	17–18	19–24	17–22
Tubercles on upper side of tail	yes	yes	yes	yes	no	yes	yes	yes
Enlarged median subcaudal scales	no	no	yes	no	no	no	no	no
No. of light bands in original tail	11–13	14–16	?	?	11	20+	?	13–15
Distribution	Bali Island (Indonesia)	Besar Island (Malaysia)	Flores & Kalao Islands (Indonesia)	Sulawesi Island (Indonesia)	E. Montalivet Island (Australia)	Java Island (Indonesia)	Christmas Island (Australia)	Seribuat Island (Malaysia)

Plate 24

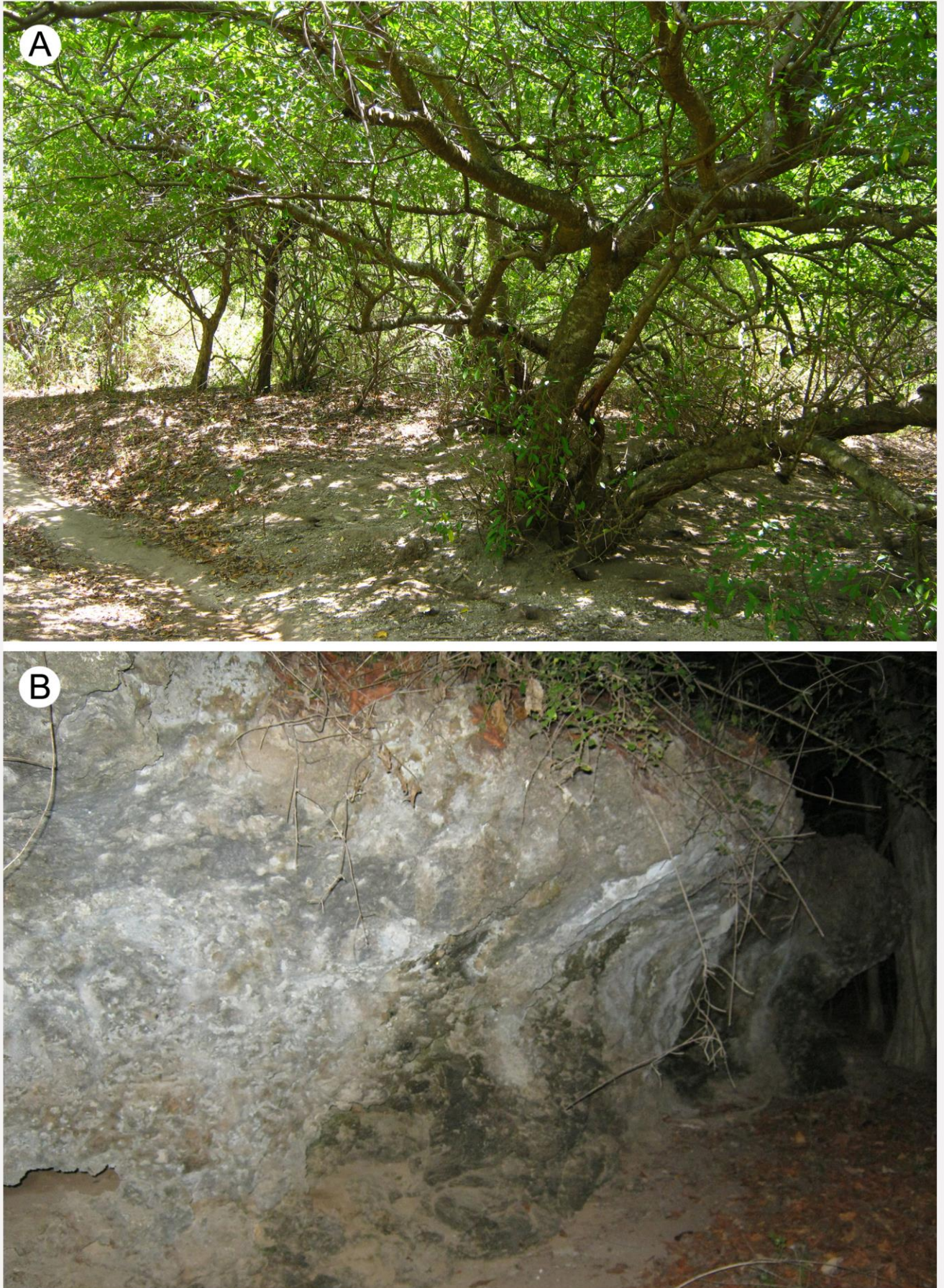


Figure 3. Habitats of *Cyrtodactylus jatnai* sp. nov. at Taman Nasional Bali Barat, Indonesia, (A) a dry monsoon and savannah forest near the beach (the holotype locality) and (B) a coral outcrop near the beach. Photograph © A.A. Thasun Amarasinghe

16), and 40–43 femoro-precloacal pores (*vs* no femoral pores and four precloacal pores) in males; from *C. consobrinus* (Peters, 1871) in being much smaller SVL 66.8 mm (*vs* 121 mm) and by having 40–48 ventral scale rows (*vs* 58–65), 17–19 lamellae on the fourth toe (*vs* 23–28), blotched dorsal color pattern (*vs.* banded), and 40–43 femoro-precloacal pores (*vs* 1–6 femoral pores and 9–10 precloacal pores separately) in males; from *C. deveti* (Brongersma, 1948) in being much smaller SVL 66.8 mm (*vs* 106 mm), and by lacking enlarged transverse median subcaudals (*vs* enlarged); from *C. fumosus* (Müller, 1895) by having 40–48 ventral scale rows (*vs* 35–40), 17–19 lamellae on the fourth toe (*vs* 20–22), tubercles along ventrolateral fold (*vs* absent), and 40–43 femoro-precloacal pores (*vs* 6 femoral pores and 10 precloacal pores separately) in males; from *C. gordongekkoi* (Das, 1994) by having 17–19 lamellae on the fourth toe (*vs* 20–23), 40–48 ventral scale rows (*vs* 30–32), and 40–43 femoro-precloacal pores (*vs* no precloacal pores) in males; from *C. gunungsenyumensis* Grismer, Wood, Anuar *et al.*, 2016 by having 24–29 paravertebral tubercles (*vs* 34–40), 40–48 ventral scale rows (*vs* 38–41), 17–19 lamellae on the fourth toe (*vs* 20–23), and 40–43 femoro-precloacal pores (*vs* poreless) in males; from *C. halmahericus* (Mertens, 1929) by having 40–43 femoro-precloacal pores (*vs* 48–53) in males; from *C. hikidai* Riyanto, 2012 in being much smaller SVL 66.8 mm (*vs* 100 mm) and by having 17–19 lamellae on the fourth toe (*vs* 22–24), and 40–43 femoro-precloacal pores (*vs* no femoral pores and 6 precloacal pores) in males; from *C. hitchi* Riyanto, Kurniati & Engilis, 2016 by lacking enlarged transverse median subcaudals (*vs* enlarged), blotched dorsal color pattern (*vs* banded), and by having 40–43 femoro-precloacal pores (*vs* poreless) in males; from *C. klakahensis* Hartmann, Mecke, Kieckbusch, 2016 by having 40–43 femoro-precloacal pores (*vs* 37–38) with two rows of enlarged precloacofemoral scales (*vs* three) in males; from *C. laevigatus* Darevsky, 1964 in being much larger SVL 66.8 mm (*vs* 38.5 mm) and by having 40–48 ventral scale rows (*vs* 30–3), 17–19 lamellae on the fourth toe (*vs* 10–15), and femoro-precloacal pores (*vs* no femoral pores) in males; from *C. lateralis* (Werner, 1896) by having 40–48 ventral scale rows (*vs* 60–64), 17–19 lamellae on the fourth toe (*vs* 21–22), and 40–43 femoro-precloacal pores (*vs* no femoral

pores and 13 precloacal pores) in males; from *C. malayanus* (De Rooij, 1915) by having 40–48 ventral scale rows (*vs* 58–62), 17–19 lamellae on the fourth toe (*vs* 21–23), blotched dorsal color pattern (*vs* banded), and 40–43 femoro-precloacal pores (*vs* no femoral pores and 8–10 precloacal pores) in males; from *C. marmoratus* Gray, 1831 by having 40–43 femoro-precloacal pores (*vs* 45–53) in males; from *C. nuaulu* Oliver, Edgar, Mumpuni *et al.*, 2009 by having 40–43 femoro-precloacal pores (*vs* no femoral pores) in males; *C. papuensis* Brongersma, 1934 by lacking deep groove-like precloacal depression (*vs* present); from *C. pubisulcus* Inger, 1958 by having 40–43 femoro-precloacal pores (*vs* no femoral pores and 7–9 precloacal pores) in males; from *C. quadrivirgatus* Taylor, 1962 by having 40–48 ventral scale rows (*vs* 34–42), and 40–43 femoro-precloacal pores (*vs* poreless or 1–4 precloacal pores) in males; from *C. semenanjungensis* Grismer & Leong, 2005 by having 40–48 ventral scale rows (*vs* 48–53), and 40–43 femoro-precloacal pores (*vs* poreless) in males; from *C. semiadii* Riyanto, Bauer & Yudha, 2014 in being much larger SVL 66.8 mm (*vs* 47.1 mm) and by having 40–43 femoro-precloacal pores (*vs* poreless) in males; from *C. spinosus* Linkem, McGuire, Hayden *et al.*, 2008 by lacking spine-like tubercles on dorsum (*vs* present) and by having 40–43 femoro-precloacal pores (*vs* no femoral pores and 12–13 precloacal pores) in males; from *C. stresemanni* Rösler & Glaw, 2008 by having 9–11 supralabials (*vs* 13), 40–48 ventral scale rows (*vs* 63), blotched dorsal color pattern (*vs* striped); from *C. tahuna* Riyanto, Arida & Koch, 2018a by having 40–48 ventral scale rows (*vs* 49–50), 17–19 lamellae on the fourth toe (*vs* 20–24), and 40–43 femoro-precloacal pores (*vs* 5 femoral pores and 14 precloacal pores) in males; from *C. tambora* Riyanto, Mulyadi, McGuire *et al.*, 2017 in being much larger SVL 66.8 mm (*vs* 47.4 mm) and by having 40–43 femoro-precloacal pores (*vs* no femoral pores and 5–6 precloacal pores) in males; from *C. tanahjampea* Riyanto, Hamidy & McGuire, 2018b by having 24–29 paravertebral tubercles (*vs* 31–34), and 40–48 ventral scale rows (*vs* 29–34), and 40–43 femoro-precloacal pores (*vs* 28–34); from *C. wallacei* Hayden, Brown, Gillespie *et al.*, 2008 in being much smaller SVL 66.8 mm (*vs* 114 mm) and by lacking enlarged transverse median subcaudals (*vs* enlarged), and by having 40–43 femoro-precloacal pores (*vs* poreless) in males; from *C.*

wetariensis (Dunn, 1927) by having 17–19 lamellae on the forth toe (*vs* 20–22) and 40–43 femoro-precloacal pores (*vs* 12–16 femoral pores and 5–6 precloacal pores) in males.

Finally, the new species differs from *C. boreoclivus*, *C. cavernicolus*, *C. elok*, *C. equitris*, *C. ingeri*, *C. matsuii*, *C. sermowaensis*, and *C. yoshii* by having enlarged femoro-precloacal sclae (*vs* not enlarged); from *C. durio*, and *C. jarakensis* by possessed an abrupt transition between rows of large and small postfemoral and ventral femoral scales (*vs* absent); from *C. astrum*, *C. aurensis*, *C. australotitiwangsensis*, *C. bintangrendah*, *C. bintangtinggi*, *C. brevipalmatus*, *C. leegrimeri*, *C. lengkawiensis*, *C. macrotubercularus*, *C. peguensis*, *C. pulchellus*, *C. rex*, and *C. trilatofasciatus* by lacking transversely enlarged median subcaudals (*vs* enlarged).

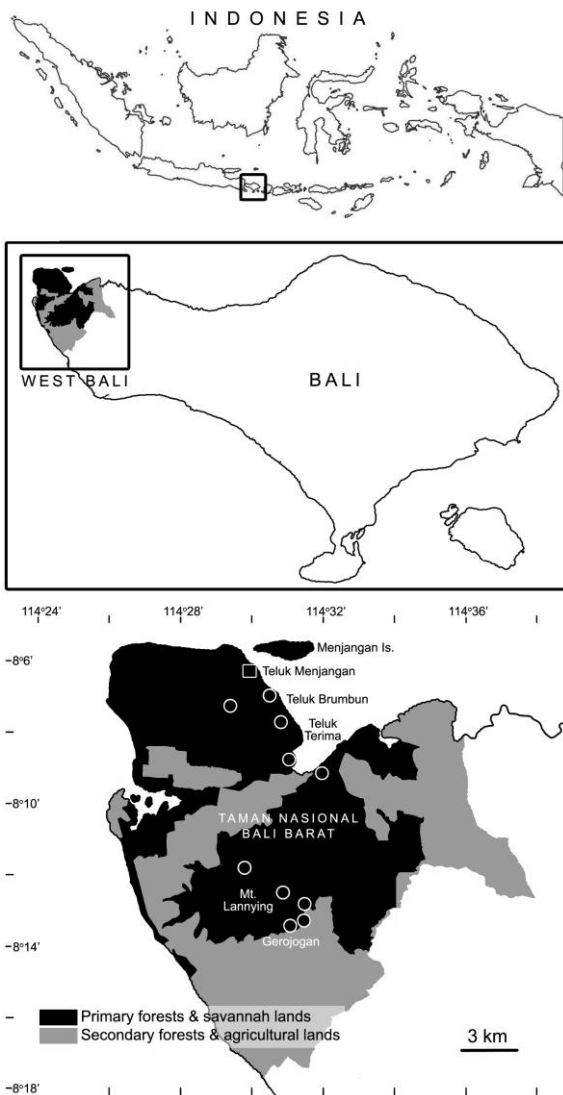


Figure 4. Distribution map of *Cyrtodactylus jatai* sp. nov. in Bali Island; the holotype locality is marked with a square symbol.

Discussion

Current phylogenetic hypotheses of SE Asian *Cyrtodactylus* of the *C. sworderi* group are based on molecular data (Grismer *et al.* 2014) and the morphological placement of *C. jatai* sp. nov. close to *C. seribuatensis* from Pulau Seribuat, West Malaysia suggests a relationship of the Bali population with Peninsular Malaysian populations rather than the other Greater Sundaic Island populations.

Cyrtodactylus rosichonariefi (*sic*) was described by Riyanto, Grismer & Wood (2015a) who placed the specific epithet “*rosichonariefi*” an eponym, as a noun in the genitive case adding the suffix [-i] directly to the stem of a modern personal name, in a case if the personal name is that of a man. However according to the etymology stated the species epithet was formed in case of men: (i) Rosichon Ubaidillah and (ii) Ahmad Jauhar Arief. Therefore the epithet “*rosichonariefi*” used by Riyanto *et al.* (2015a), is improperly constructed and, and the correct epithet would be “*rosichonarieforum*”, adding the suffix [-orum].

Cyrtodactylus jatai sp. nov. is the only *Cyrtodactylus* reported from West Bali and is endemic to that Island. It will be interesting to know if congeners occur in eastern parts of Java or if these geckos have crossed the relatively narrow Bali Strait to Java. Answering these questions will require additional fieldwork in the many poorly explored parts of eastern Java. We assume that more surveys and comprehensive taxonomic studies will increase the known biodiversity of Bali Island, as well as the evolutionary position of Bali’s fauna in relation to Sundaland and Lesser Sunda.

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Appendix I. Other specimens examined

- Cyrtodactylus batucolus* (1 ex.): **West Malaysia:** Besar Island: ZRC 2.6743 (holotype).
- C. darmandvillei* (3 ex.): **Indonesia:** Flores: ZMA.RENA 10943–44 (syntypes); Timor: FMNH 154845.
- C. fumosus* (1 ex.): **Indonesia:** North Sulawesi: NMB 2662 (holotype).
- C. jellesmae* (2 ex.): **Indonesia:** Central Sulawesi: NMB 2660 (lectotype), 2661 (paralectotype).
- C. kimberleyensis* (1 ex.): **Western Australia:** WAM R164144 (holotype).
- C. petani* (13 ex.): **Indonesia:** East Java: MZB 12899 (holotype), 11706 – 13 (paratypes), 12143 (paratype), 12898–99 (paratypes), 12900 (paratype).
- C. sadleiri* (1 ex.): **Australia:** Christmas Island: AMS R95535 (holotype).
- C. seribuatensis* (10 ex.): **West Malaysia:** Seribuat Island: ZRC 2.6147 (holotype), 2. 6149–52 (paratypes); Nangka Kecil Island: 2.6148 (paratype); Sibuluan Island: 2.6153 (paratype); Sibuluan Tengah Island: 2.6154 (paratype); Mentigi Island: 2.6155 (paratype); Sembilang Island: 2.6156 (paratype).

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