

Redescription of *Lepidodactylus flaviocularis* (Squamata: Gekkonidae), with the description of a new species from Makira Island, Solomon Islands

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Abstract

Several species of geckos of the genus *Lepidodactylus* are endemic to the Solomon Islands and very poorly known. I redescribe one of these, *L. flaviocularis*, from Guadalcanal, based on examination of a second, newly obtained specimen and quantification of diagnostically useful features of the digits. I also describe a closely related new species from nearby Makira Island in the southern Solomon Islands. Both species are distinguished by their large number of undivided subdigital lamellae, extensive toe webbing, and a continuous row of enlarged precloacal/femoral scales. The new species is distinguished from *L. flaviocularis* by a number of scalational features and the color of the circumorbital scales. Both species are inhabitants of interior forest, and it remains uncertain whether they are naturally rare, rare due to interactions with invasive species, or simply have cryptic ecological habits, though the last seems most likely. Current evidence for both species is consistent with the taxon-cycle hypothesis, which posits ecological displacement to inland habitats of ancient island inhabitants by newer colonizers, but this remains to be critically tested. The limited pool of specimens available for both species necessitates assessing the IUCN conservation status of each as Data Deficient.

Key words: endemism, gecko, IUCN red list, rarity, taxon cycle

Introduction

The lizards of the Solomon Islands (the geological, not political, entity) comprise 59 known species in four families (McCoy 2021). Of these, 33 species are endemic to this archipelago, which is unsurprising inasmuch as these islands are of intra-oceanic origin and have always been geologically independent of biotic source areas to the west (Pettersen *et al.* 1999; Hall 2002), making their biota the result of rare trans-marine colonization events. Consequently, the size of this fauna and its degree of endemism are much less than what are found on New Guinea or adjacent archipelagos to the west of the Solomons (Kraus 2021; Uetz *et al.* 2023), and the same is true for frogs (Oliver *et al.* 2022). Nonetheless, the numerous islands comprising this archipelago, their degree of isolation, and divergent geological histories make the evolution of their herpetofauna of interest (Oliver *et al.* 2018a). Despite this, the region has not been as rigorously surveyed in recent years as areas to the west, so additional species seem likely to be recognized following further survey and taxonomic study (e.g., Weijola *et al.* 2019; McCoy 2021). Part of the difficulty in gaining a comprehensive taxonomic understanding of the Solomon Island herpetofauna is the need for surveys and comparative studies across many of the constituent islands of the region.

Within the Solomon Island lizard community, 15 species in seven genera are geckos, of which six belong to the genus *Lepidodactylus* Fitzinger (McCoy 2021). *Lepidodactylus* as currently defined is a paraphyletic portion of a broader clade that also includes *Pseudogecko* Taylor and two lineages of *Luperosaurus* Gray (Oliver *et al.* 2018b). This larger clade of *Lepidodactylus sensu lato* includes 62 named species and 31 candidate species (McDonald *et al.* 2022; Kraus *et al.* 2023), making it the most-speciose genus of geckos in the Pacific Basin (although *Cyrtodactylus* Gray is more speciose overall, most of its species are Asian, and relatively few inhabit the Pacific Basin per se [Grismer *et al.* 2021]). Melanesia contains 23 species of *Lepidodactylus* (Uetz *et al.* 2023), all but two endemic to the region and typically to single islands. Of the six species known from the Solomon Islands three are endemic there, with *L. shebae* (Brown & Tanner) and *L. flaviocularis* Brown, McCoy, & Rodda each known from only one

and two specimens, respectively, from Guadalcanal and *L. mutahi* Brown & Parker known only from Bougainville (Brown & Tanner 1949; Brown & Parker 1977; Brown *et al.* 1992; McCoy 2021). Given the large number of islands in this archipelago one might expect a greater number of endemic *Lepidodactylus* to actually occur in the region, especially inasmuch as the known endemics are based on so few specimens.

In the course of investigating the status of *Lepidodactylus laticinctus* Kraus *et al.* 2023 and comparing it to its near relatives in the *L. guppyi* Group, I was loaned a supposed *L. guppyi* from Makira Island at the southern end of the Solomon Island chain. The specimen clearly was not *L. guppyi* because it lacked divided subterminal lamellae and had a much greater number of lamellae under the fourth toe than does *L. guppyi*. These two features make the specimen similar to the endemic *L. flaviocularis*, known only from nearby Guadalcanal. However, this specimen was also bleached and unacceptable for diagnosing it against *L. flaviocularis*. Subsequently, another loan from a different museum also included a second supposed *L. guppyi* Boulenger specimen from Makira having the same unique features. This specimen is fresh, so that better diagnostic information on color pattern is available. With the availability of both specimens this unique species can now be reliably diagnosed. To do so, it is advisable to first rediagnose *L. flaviocularis* for two reasons. First, a second, fresh specimen of that species is now also available, allowing for an expanded understanding of variation in that poorly known species. Second, some of the features (e.g., degree of webbing, toe width) used in the original diagnosis of this species (Brown *et al.* 1992) were not quantified, and providing such quantification allows for better assessment of potential diagnostic differences against the new species from Makira as well as other members of the genus.

Materials and methods

I measured snout-vent length using a ruler, tail length with either a ruler (on straight tails) or a non-elastic string laid along the tail and then placed along a ruler (for curled tails), and all other measurements using a binocular dissecting scope with an attached micrometer or with vernier calipers. I measured snout-vent length and tail length, and trunk length to the nearest 0.5 mm and all other measurements to the nearest 0.1 mm. Measurements include: snout-vent length (SVL), from tip of snout to vent; trunk length (TrL), from posterior edge of forearm insertion to anterior edge of hindleg insertion; tail length (TL), from vent to tip of tail; tail width (TW), measured at widest point of tail behind the cloacal sacs; head length (HL), from tip of snout to anterior margin of ear opening, taken in lateral view; head width (HW), maximum width of head; forearm length (FA), from central base of palm to elbow; crus length (CS), from central base of heel to knee; ear diameter (Ear), longest dimension of ear, typically on a diagonal axis; eye diameter (EY), greatest horizontal diameter of eye between the surrounding scales; eye-naris distance (EN), from anteriormost point of eye to center of naris; snout length (SN), from anteriormost point of eye to tip of snout, taken in lateral view; internarial distance (IN), distance between centers of nares; ear-to-eye distance (EE), shortest straight-line distance between anterior edge of ear opening to posterior corner of eye; length of the fourth toe, from terminal lamella to the base of the web between T3 and T4 (T4L); width of the fourth toe across its widest point (T4W); length of the series of complete lamellae on the fourth toe (T4lamellaeL); length of webbing between T3 and T4 from base of this webbing to its center of emargination (T3T4webL), and length of webbing between T4 and T5 from base of this webbing to its center of emargination (T4T5webL). I counted numbers of supralabials to mid-eye, infralabials to corner of jaw, lamellae under each digit, enlarged precloacal/femoral scales, number of precloacal/femoral pores (in males), number of precloacal scales in a straight line between the apex of the precloacal pore-bearing series and the cloaca, and width of the pale ventral field as number of scales in a direct line from the darker lateral coloration on one side to the other.

As noted by Kraus (2019), Brown & Parker's (1977) treatment of the genus and Brown *et al.*'s (1992) description of *L. flaviocularis* used toe width, degree of toe webbing, and extent of lamellae along the toe (referred to them as “scansors”) as diagnostic features, but each of those was described in approximate terms (e.g., “toes one-third webbed”) and not quantified. I follow Kraus (2019) in including the assorted toe, lamella, and webbing measurements noted above so as to obtain more precise measures of differences in these features.

Specimens of the new species are deposited in the British Natural History Museum, London (BMNH), and at the University of Kansas Biodiversity Institute, Lawrence (KU). I compared these directly to the two known specimens of *Lepidodactylus flaviocularis* in the United States National Museum, Washington, DC (USNM) and KU and to data available for other members of the genus from Brown & Tanner (1949), Brown (1964), Brown & Parker (1977), Kraus (2019), Karkkainen *et al.* (2020), Kraus & Oliver (2020), and Kraus *et al.* (2022, 2023).

Results

Lepidodactylus flaviocularis Brown, McCoy, & Rodda, 1992: 440.

Figs. 1, 2A

Holotype: u SNM 313865, mature male, collected by G.H. Rodda on Mt. Austen, Guadalcanal Island, Solomon Islands, 23 November 1990.

Diagnosis. A moderately sized species of *Lepidodactylus* (SVL = 44.0–46.0 mm) with all lamellae undivided; 37–38 enlarged pore-bearing precloacal/femoral scales in a continuous row extending to distal end of each thigh; 38 precloacal/femoral pores in sole male; T3T4webL = 0.26–0.27, T4T5webL = 0.14–0.18, 15–21 lamellae beneath T4, covering most of digit (T4lamellaeL/T4L = 0.88–0.94); EN/IN = 1.86–1.96; pale ventral field ~25 scale rows wide; yellow circumorbital ring in life.

Comparisons with other species. The absence of any divided lamellae under the digits places this species in Brown & Parker's (1977) phenetic Group I. From other members of this group, *L. flaviocularis* is distinguished as follows: from *L. magnus* Brown & Parker, *L. oorti* (Kopstein), and *L. sacrolineatus* Kraus & Oliver by its smaller size (adult SVL = 50–71 mm in *L. magnus*, 53–57 mm in *L. oorti*, 52–60 mm in *L. sacrolineatus*) and more extensive toe webbing (T3T4webL = 0.26–0.27 vs. 0.11–0.17 in those three species); from *L. pumilus* (Boulenger), *L. sacrolineatus*, and *L. zweifeli* Kraus in having a continuous row of enlarged pore-bearing scales (vs. pores arrayed into three series in those three species); from *L. aignanus* Kraus in having 37–38 enlarged scales of the pore-bearing series in a continuous row extending to distal end of each thigh (vs. 17 enlarged pore-bearing scales limited to precloacal region in *L. aignanus*); from *L. euaensis* Gibbons & Brown, *L. listeri* (Boulenger), *L. manni* Schmidt, *L. mutahi*, *L. orientalis* and *L. pumilus* in having 15–21 lamellae under T4 (vs. 8–13 in those six species). Among Melanesian *Lepidodactylus*, only *L. pulcher* Boulenger has as many lamellae (16–19) beneath T4, but that species differs from *L. flaviocularis* in having 1–2 divided subterminal lamellae under T4. The yellow eye ring in life distinguishes *L. flaviocularis* from all other members of the genus except *L. gardineri*, which has divided subterminal lamellae.

Redescription of the holotype. A mature male of medium size (SVL = 46.0 mm); tail missing. Head relatively long (HL/SVL = 0.26) and wide (HW/HL = 0.82), distinct from neck (Fig. 1A). Loreal region slightly inflated; no distinct canthus rostralis. Top of snout, area between nares, and area posterior to nares shallowly concave. Snout tapered and rounded at tip, relatively long (SN/HL = 0.44), significantly longer than eye diameter (SN/EY = 1.8). Eye of modest size (EY/HL = 0.25, EY/EN = 0.64); pupil vertical, constricted into series of four lobes; anterior supraciliaries slightly larger than adjacent granules, posterior ones subequal to adjacent granules. Ear opening small (Ear/HL = 0.093), narrowly compressed, oriented obliquely; distance between ear and eye larger than eye diameter (EE/EY = 1.3). Nostril twice as wide (1.9 mm) as high (0.9 mm), highest just medial to nares, lower between these points; length 0.35 mm. Supranasals separated by three internasals along posterior rostral margin. Nostril in contact with first supralabials, two supranasals, and three internasals. External nares circular; each bordered by rostral, two supranasals, first supralabial, and one postnasal. Mental triangular, 0.70 mm wide. Mental bordered posteriorly by two tiny scales; no enlarged postmentals but small field of slightly enlarged chin scales progressively decrease in size posteriorly to join granular chin scales. First five infralabials bordered below by enlarged scales, but fourth and fifth infralabials separated from these by intervening small scales; remaining scales below infralabials of approximately same size as throat scales, which decrease in size medially. Supralabials to mid-orbital position ten on each side; only two more enlarged supralabials posterior to this; angle of jaw bordered with granular scales. Infralabials 15 (r) and 14 (L).

Body of rather narrow habitus (TrL/SVL = 0.46), slightly depressed. Dorsal scales on head, body, limbs, and throat tiny, juxtaposed granules, slightly larger on sides and snout; tubercles absent. Ventral scales larger, flat and smooth, subimbricate, gradually decreasing in size laterally to become granular.

Enlarged precloacal/femoral scales in single series of 38 scales extending to distal end of each thigh, 38 precloacal/femoral pores (Fig. 1B); thigh scales anterior to this row larger than those posterior. Enlarged scales form a pubic patch between precloacal series and vent; tiny scales intruding laterally between precloacal series and pubic patch but not forming a continuous row; nine scales in a row between apex of enlarged precloacal series and vent. Scales on palms and soles rounded, flattened, smooth, subimbricate.

Fore- and hindlimbs relatively small (FA/SVL = 0.11, CS/SVL = 0.14). Digits well-developed (Fig. 1C, D),

moderately dilated throughout their length ($T4W/T4L = 0.29$), all but first fingers and toes with recurved claws; clawed phalanges laterally compressed, free above and extending slightly beyond terminal lamellae. Subdigital lamellae narrow and smooth, all undivided (Fig. 1C, D); lamellae extend for almost entire length of each toe ($T4lamellaeL/T4L = 0.94$). Lamellae of manus 9–11–13–15–10 on right, 10–11–13–14–11 on left; of pes 11–13–17–21–11 on right, 11–12–16–18–11 on left. *r* relative lengths of digits on manus and pes $I < II < V < III < IV$. Webbing present between all digits, most extensive between T3 and T4 ($T3T4webL/T4L = 0.27$, $T4T5webL/T4L = 0.18$). A fringe of scales extends from base of fifth toe anterior along inner margin of leg.

Tail missing. Cloacal sacs swollen (Fig. 1B), with small external orifices situated near lateral margins of vent; one (*r*) or two (*L*) slightly enlarged, blunt postcloacal spurs on each side of tailbase; midventral scales of sac hexagonal, subimbricate, slightly larger than those ventrolaterally.

Color in preservative: Dorsal ground color on body, head, and limbs pale brown (Fig. 1A), each scale very pale brownish white punctated with black; approximately five slightly darker areas mid-dorsally between nape and tail base. Venter same pale brownish-white ground with far fewer scales punctated with black, giving overall whitish appearance (Fig. 1B). Palmar, plantar and subdigital surfaces pale yellow gray; tips of digits with some brown (Fig. 1C, D). Circumorbital scales brown externally, pale brownish white on side adjacent to eye. Pupil tan with some gold near margins, veined with brown.

Measurements (in mm). SVL = 46.0, TrL = 21.0, FA = 5.0, CS = 6.3, HL = 11.8, HW = 9.7, Ear = 1.1, EE = 3.9, EY = 2.9, SN = 5.2, EN = 4.5, IN = 2.3, T4L = 5.1, T4W = 1.5, T4lamellaeL = 4.8, T3T4webL = 1.4, T4T5webL = 0.9.

Variation. A single additional specimen (Ku 341207) has been collected since the holotype, doubling the number of specimens available to assess morphological variation in this species. It is from Barana, Moka river, 9.5060°S, 159.9811°E, 275 m a.s.l., Guadalcanal Island, Solomon Islands and was collected by S. Travers and company on 10 February 2014.

This specimen differs from the holotype in being female, having 14 (*r*) and 13 (*L*) infralabials, and 37 enlarged precloacal/femoral scales. Lamellae of manus 10–11–13–13–11 on right, 10–11–13–15–9 on left; of pes 9–13–15–18–12 on right, 9–12–15–15–9 on left. The lamellae on T4 of the left pes are arranged in a series of 13, separated by a row of small scales, followed by another lamella, then another row of small scales, and then a final lamella, counting distally to proximally. This specimen also has less webbing between the fourth and fifth toes ($T4T5webL/T4L = 0.14$ instead of 0.18). The fringe of scales from the base of the fifth toe and along the hindlimb is reduced and barely discernable. This specimen was collected 23 years after the holotype, and the color is correspondingly better. The dorsal ground color is similar to the holotype but is slightly darker, and there is a vague darker-brown blotch on top of the head, another above the scapulae, and the top of the snout is darker brown. The brown under the tips of the digits is clearer than in the holotype. The venter is similar to the holotype but has somewhat more dark punctations than are seen in the holotype. The eyelids are dark gray, and the iris is tan.

Measurements of KU 341207 (in mm). –SVL = 44.0, TrL = 23.0, FA = 5.1, CS = 5.9, HL = 11.2, HW = 8.7, Ear = 0.9, EE = 3.7, EY = 2.7, SN = 5.0, EN = 4.1, IN = 2.2, T4L = 4.2, T4W = 1.5, T4lamellaeL = 3.7, T3T4webL = 1.1, T4T5webL = 0.6.

Color in life. A photo of an animal collected by Mike McCoy in 1978 but not preserved is reddish with six darker red-brown saddles between the nape and hindlimb insertion (Fig. 2A). The yellow scales around the orbit are clearly visible. A photo of the holotype taken by Gordon Rodda (not illustrated here) shows an animal that is yellow-tan instead of reddish. The dorsal bands on that animal are somewhat narrower, and the yellow eye ring is again evident. Both of these animals were figured in Brown *et al.* (1992) in black and white. A third specimen is illustrated in Oliver *et al.* (2018b) and McDonald *et al.* (2022) and is similar to Fig. 2A.

Remarks. Brown *et al.* (1992) recorded the SVL of the holotype as 49.5 mm in life and 47.5 mm in preservative approximately two years after preservation. I now obtain a SVL measurement of 46.0 mm, reflecting additional shrinkage since 1992. Brown *et al.* (1992) and I also differ in one of the scale counts. They claimed that there were 18 lamellae under the fourth toe; I count 18 on the left foot but 21 on the right. It is possible that they only counted lamellae on one side of the specimen; however, they also counted 10 or 11 lamellae under the first toe, suggesting that they counted lamellae on both sides. Our count difference on the right foot for number of T4 lamellae may be due to their ignoring three smaller proximal lamellae that I included. These were not as wide as the more distal lamellae but are still three times or more wider than deep, so I included them in the count.

***Lepidodactylus makira* sp. nov.**

Figs. 2B, 3

Holotype. Ku 350843 (field tag SLT 1204), mature female, collected by I. Tigulu at Na'ra Village, Naepaepa Mt., Central Bauro Highlands, 10.5639°S, 161.9049°E, 775 m a.s.l., Makira Island, Makira Province, Solomon Islands, 4 July 2018.

Paratype. BMNH 1973.222, mature male, collected 7 mi (11.6 km) S of Wainoni (presumably Wainoni Bay, since I can find no village of that name), Makira Island, Makira Province, Solomon Islands. The BMNH catalogue lists no collector or collection date for this specimen.

Diagnosis. An intermediately sized (adult female SVL 52.5 mm, adult male 45.0 mm) species of *Lepidodactylus* having 44–45 enlarged pore-bearing precloacal/femoral scales in a continuous row extending to distal end of each thigh, 45 precloacal/femoral pores in sole male, enlarged scales of pore-bearing series entirely separated from patch of enlarged pubic scales by intervening row of tiny scales, entirely undivided subterminal lamellae on all toes though two on each toe may be grooved, 17–19 T4 lamellae, 12 T1 lamellae, moderately long toes ($T4L/SVL = 0.10\text{--}0.11$), lamellae occupying almost all of toes or extending onto palm ($T4\text{ lamellae}L/T4L = 0.94\text{--}1.04$), toes fairly wide ($T4W/T4L = 0.32\text{--}0.36$) with extensive webbing ($T3T4\text{web}L/T4L = 0.28\text{--}0.30$, $T4T5\text{web}L/T4L = 0.22\text{--}0.28$), two internasals between supranasals along posterior margin of rostral, 8–10 supralabials to center of eye, circumorbital scales dark brown, foot webbing dark brown dorsally and ventrally, dorsum dark brown with darker-brown dorsolateral and lateral blotches, and pale ventral field ~15 scale rows wide.

Comparisons with other species. The undivided lamellae under the toes place *Lepidodactylus makira* sp. nov. in Brown & Parker's (1977) phenetic Group I. Hence, it is readily distinguished from Melanesian species belonging to Group II (*L. buleli* Ineich, *L. dialeukos* Kraus, *L. gardineri* Boulenger, *L. guppyi*, *L. kwasnickae* Kraus, *L. laticinctus*, *L. mitchelli* Kraus, *L. novaeguineae* Brown & Parker, *L. pulcher*, *L. shebae*), which have two or more divided subterminal lamellae, and from Group III species (*L. lugubris* [Duméril & Bibron], *L. pantai* Stubbs, Karin, Arifin, Iskandar, Arida, Reilly, Bloch, Kusnadi & McGuire, and *L. woodfordi* Boulenger), which have the terminal and several subterminal lamellae divided.

From other Group I species, *L. makira* sp. nov. is distinguished from *L. aignanus*, *L. listeri*, *L. manni*, and *L. orientalis* in having a continuous row of 45 precloacal/femoral pores in the sole male (vs. 31 or fewer precloacal/femoral pores in *L. aignanus*, *L. listeri*, *L. manni*, *L. orientalis*) and far more T4 lamellae (17–19 vs. 9–12 in *L. aignanus*, *L. listeri*, *L. manni*, *L. orientalis*); from *L. pumilus*, *L. sacrolineatus*, and *L. zweifeli* by its continuous row of precloacal/femoral pores and enlarged precloacal/femoral scales (vs. enlarged precloacal scales/pores divided from enlarged femoral scales/pores by intervening smaller scales lacking pores, producing three discrete pore series in *L. pumilus*, *L. sacrolineatus*, and *L. zweifeli*); from *L. magnus* by its much smaller size (45.0–52.5 mm SVL vs. 50–71 mm in *L. magnus*), greater number of T4 lamellae (17–19 vs. 11–14 in *L. magnus*), and greater amount of toe webbing ($T3T4\text{web}L/T4L = 0.28\text{--}0.30$ vs. $0.12\text{--}0.19$ in *L. magnus*); from *L. oorti* in its greater number of T4 lamellae (17–19 vs. 12–14 in *L. oorti*) and T1 lamellae (11–12 vs. 9–10 in *L. oorti*), greater number of enlarged precloacal/femoral scales (44–45 vs. 32–36 in *L. oorti*) and pores (45 vs. 28–30 in *L. oorti*), and greater toe webbing (all toes webbed and $T3T4\text{web}L/T4L = 0.28\text{--}0.30$ vs. basal webbing only between T3 and T4 in *L. oorti*); and from *L. euaensis* and *L. mutahi* in its greater number of T4 lamellae (17–19 vs. 10–13 in *L. euaensis*, 10–11 in *L. mutahi*) covering most of toe or more ($T4\text{ lamellae}L/T4L = 0.94\text{--}1.04$ vs. ~ 0.75 in *L. euaensis*, ~ 0.67 in *L. mutahi*), greater number of enlarged precloacal/femoral scales (44–45 vs. 28–36 in *L. mutahi*) and pores (45 vs. 33 in *L. euaensis*, 27–34 in *L. mutahi*).

Lepidodactylus makira sp. nov. is most similar to *L. flaviocularis* from nearby Guadalcanal. From that species, *L. makira* sp. nov. differs in its larger size (female SVL 52.5 mm vs. 46.0 mm in *L. flaviocularis*) and in having more extensive toe webbing ($T3T4\text{web}L = 0.28\text{--}0.30$ vs. $0.26\text{--}0.27$ in *L. flaviocularis*, $T4T5\text{web}L = 0.22\text{--}0.28$ vs. $0.14\text{--}0.18$ in *L. flaviocularis*), two internasal scales (vs. three in *L. flaviocularis*), 45 precloacal/femoral pores in the sole male (vs. 36 in the sole male *L. flaviocularis*), 44–45 enlarged precloacal/femoral scales (vs. 36–37 in *L. flaviocularis*), a continuous row of tiny scales entirely separating the enlarged pore-bearing precloacal/femoral scales from the patch of enlarged pubic scales (vs. tiny scales only intervening between these enlarged scale series laterally in *L. flaviocularis*), brown circumorbital scales (vs. yellow in *L. flaviocularis*), and pale ventral field 15 scale rows wide (vs. ~25 rows wide in *L. flaviocularis*).

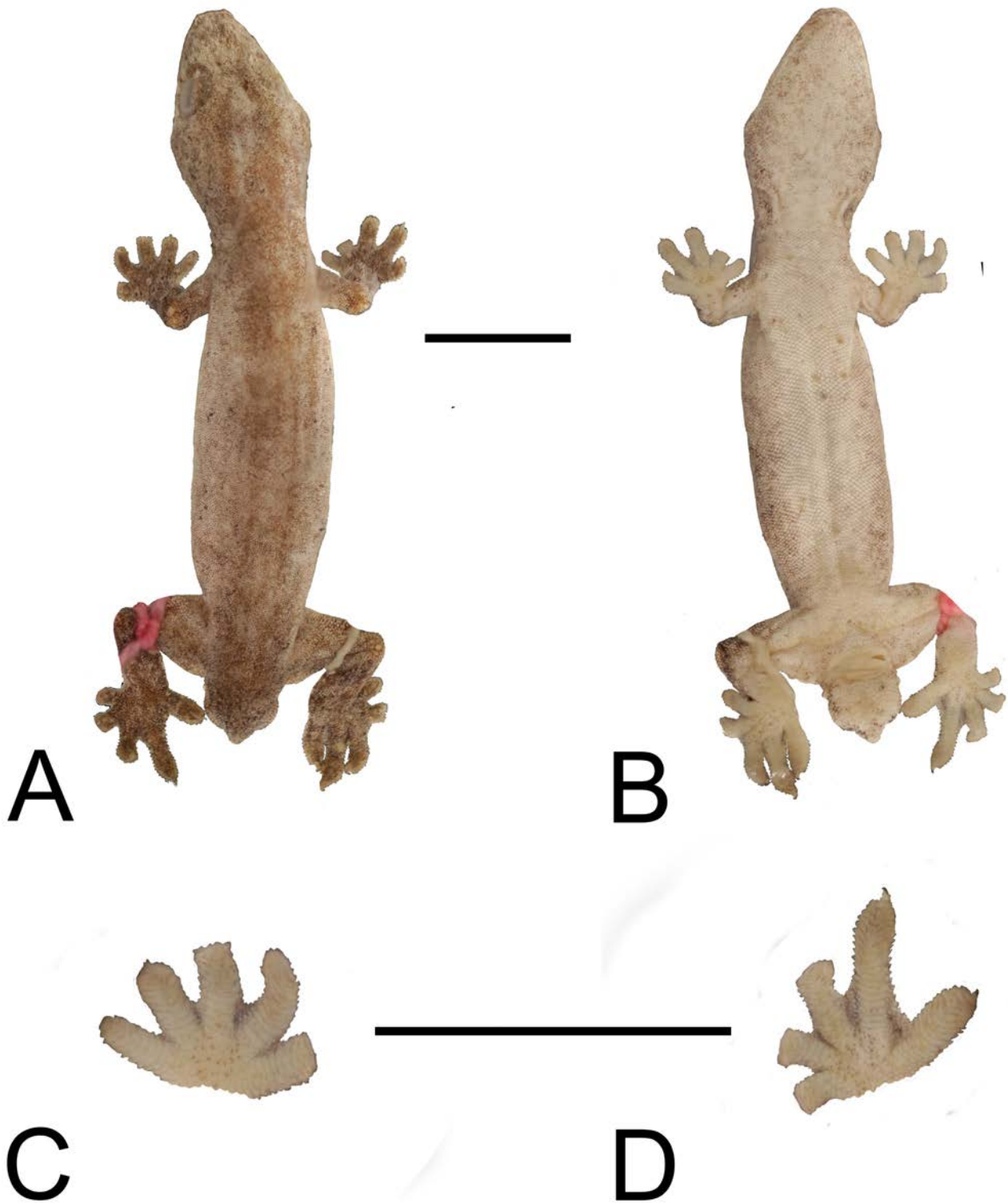


FIGURE 1. (A) Dorsum, (B) venter, (C) palmar view of left hand, and (D) plantar view of left foot of holotype of *Lepidodactylus flaviocularis* (u SNM 313865), Mt. Austen, Guadalcanal Island, Solomon Islands. Scale bars are 1 cm.

Description of holotype. A mature female of medium size (SVL = 52.5 mm) with a mid-ventral incision behind the pectoral region. Head relatively long ($HL/SVL = 0.24$) and wide ($HW/HL = 0.82$), distinct from neck (Fig. 3A). Loreal region slightly inflated; no distinct canthus rostralis. Top of snout, area between nares, and area posterior to nares shallowly concave. Snout tapered and rounded at tip, relatively long ($SN/HL = 0.45$), significantly longer than eye diameter ($SN/EY = 1.9$). Eye of modest size ($EY/HL = 0.23$, $EY/EN = 0.64$); pupil vertical, constricted into series of four lobes; anterior supraciliaries slightly larger than adjacent granules, posterior ones subequal to adjacent

granules. Ear opening small ($\text{Ear/HL} = 0.086$), narrowly compressed, oriented obliquely; distance between ear and eye larger than eye diameter ($\text{EE/EY} = 1.4$). r ostral twice as wide (2.4 mm) as high (1.2 mm), highest just medial to nares, lower between these points; length 0.55 mm. Supranasals separated by two internasals along posterior rostral margin. r ostral in contact with first supralabials, two supranasals, and two internasals. External nares circular; each bordered by rostral, two supranasals, first supralabial, and one postnasal. Mental triangular, 0.95 mm wide. Mental bordered posteriorly by one small scale, and this bordered posteriorly by subequal scales that progressively decrease in size posteriorly to join granular chin scales. First five infralabials bordered below by enlarged scales; remaining scales below infralabials smaller, rapidly decreasing posteriorly to approximately same size as throat scales, which decrease in size medially. Supralabials to mid-orbital position eight on each side; three (r) or two (L) enlarged supralabials posterior to this; angle of jaw bordered with granular scales. Infralabials 12 (r) and 11 (L).

Body of rather narrow habitus ($\text{TrL/SVL} = 0.52$), slightly depressed. Dorsal scales on head, body, limbs, and throat tiny, juxtaposed granules, slightly larger on sides and snout; tubercles absent. Ventral scales larger, flat and smooth, subimbricate, gradually decreasing in size laterally to become granular.

Enlarged precloacal/femoral scales in single series of 44 scales extending to distal end of each thigh, 20 of these containing small, shallow pores or dimples; thigh scales anterior to this row larger than those posterior. Enlarged scales form a pubic patch between precloacal series and vent (Fig. 3B); continuous row of tiny scales entirely separate precloacal series and pubic patch; nine scales in a row between apex of enlarged precloacal series and vent. Scales on palms and soles rounded, flattened, smooth, subimbricate.

Fore- and hindlimbs relatively small but well-developed ($\text{FA/SVL} = 0.10$, $\text{CS/SVL} = 0.13$). Digits well-developed (Fig. 3C, D), moderately dilated throughout their length ($\text{T4W/T4L} = 0.36$), all but first fingers and toes with recurved claws; clawed phalanges laterally compressed, free above and extending slightly beyond terminal lamellae. Subdigital lamellae narrow and smooth, all undivided (Fig. 3C, D); lamellae extend for entire length of each toe ($\text{T4lamellaeL/T4L} = 1.04$). Lamellae of manus 11–12–14–16–12 on right, 9–13–14–15–11 on left; of pes 12–15–16–18–12 on right, 12–13–16–19–12 on left. r elative lengths of digits on manus and pes $\text{I} < \text{II} < \text{V} < \text{III} < \text{IV}$. Webbing present between all digits, most extensive between T3 and T4 ($\text{T3T4webL/T4L} = 0.30$, $\text{T4T5webL/T4L} = 0.28$). A fringe of scales extends from base of fifth toe anteriorly along inner margin of leg.

Tail missing. Cloacal sacs not swollen (Fig. 3B), with small external orifices situated near lateral margins of vent; three (r) or two (L) slightly enlarged, blunt postcloacal spurs on each side of tailbase; midventral scales of sac hexagonal, subimbricate, slightly larger than those ventrolaterally.

Color in preservative: Dorsal ground color on body, head, and limbs dark brown with four dark chocolate-brown dorsolateral blotches between limbs on each side (Fig. 3A) below which are several smaller dark chocolate-brown lateral blotches. Approximately 15 mid-ventral rows of white scales; sides of venter brown like dorsum. Chin and throat white heavily spotted with brown, brown decreasing posteriorly (Fig. 3B). Palmar and plantar surfaces white punctated with some brown (Fig. 3C, D); tips of digits brown; webbing dark brown above and below. Iris gold veined with brown.

Measurements (in mm). $\text{SVL} = 52.5$, $\text{TrL} = 27.5$, $\text{FA} = 5.4$, $\text{CS} = 7.0$, $\text{HL} = 12.8$, $\text{HW} = 10.5$, $\text{Ear} = 1.1$, $\text{EE} = 4.3$, $\text{EY} = 3.0$, $\text{SN} = 5.8$, $\text{EN} = 4.7$, $\text{IN} = 2.6$, $\text{T4L} = 5.0$, $\text{T4W} = 1.8$, $\text{T4lamellaeL} = 5.2$, $\text{T3T4webL} = 1.5$, $\text{T4T5webL} = 1.4$.

Variation. The sole paratype is similar to the holotype in most respects but is a male of smaller size (45.0 mm SVL), with 45 enlarged precloacal/femoral scales and 45 well-developed precloacal/femoral pores that extend to distal end of each thigh. It has nine (r) and ten (L) supralabials to center of eye, and 14 infralabials on each side. Lamellae of manus 9–13–14–17–14 on right, 11–13–17–17–13 on left; of pes 12–16–17–17–14 on right, 12–14–19–18–14 on left. It has somewhat less toe webbing ($\text{T3T4webL/T4L} = 0.28$, $\text{T4T5webL/T4L} = 0.22$), but this may reflect a longer period of shrinkage in alcohol. The specimen is highly bleached such that reliable information on color pattern is unavailable.

Measurements of paratype (in mm). $\text{SVL} = 45.0$, $\text{TrL} = 23.0$, $\text{FA} = 4.7$, $\text{CS} = 6.0$, $\text{HL} = 11.8$, $\text{HW} = 9.2$, $\text{Ear} = 1.0$, $\text{EE} = 4.0$, $\text{EY} = 2.9$, $\text{SN} = 5.2$, $\text{EN} = 4.3$, $\text{IN} = 2.4$, $\text{T4L} = 5.0$, $\text{T4W} = 1.6$, $\text{T4lamellaeL} = 4.7$, $\text{T3T4webL} = 1.4$, $\text{T4T5webL} = 1.1$.

Color in life. A photo of the holotype in life (Fig. 2B) shows an animal that is yellow brown dorsally with five dark-brown dorsolateral blotches and smaller dark-brown lateral spots. It has two narrow brown lines behind the eye followed by three smaller brown lines arrayed behind those. The eye is golden, and the circumorbital scales are the same color as the dorsum.

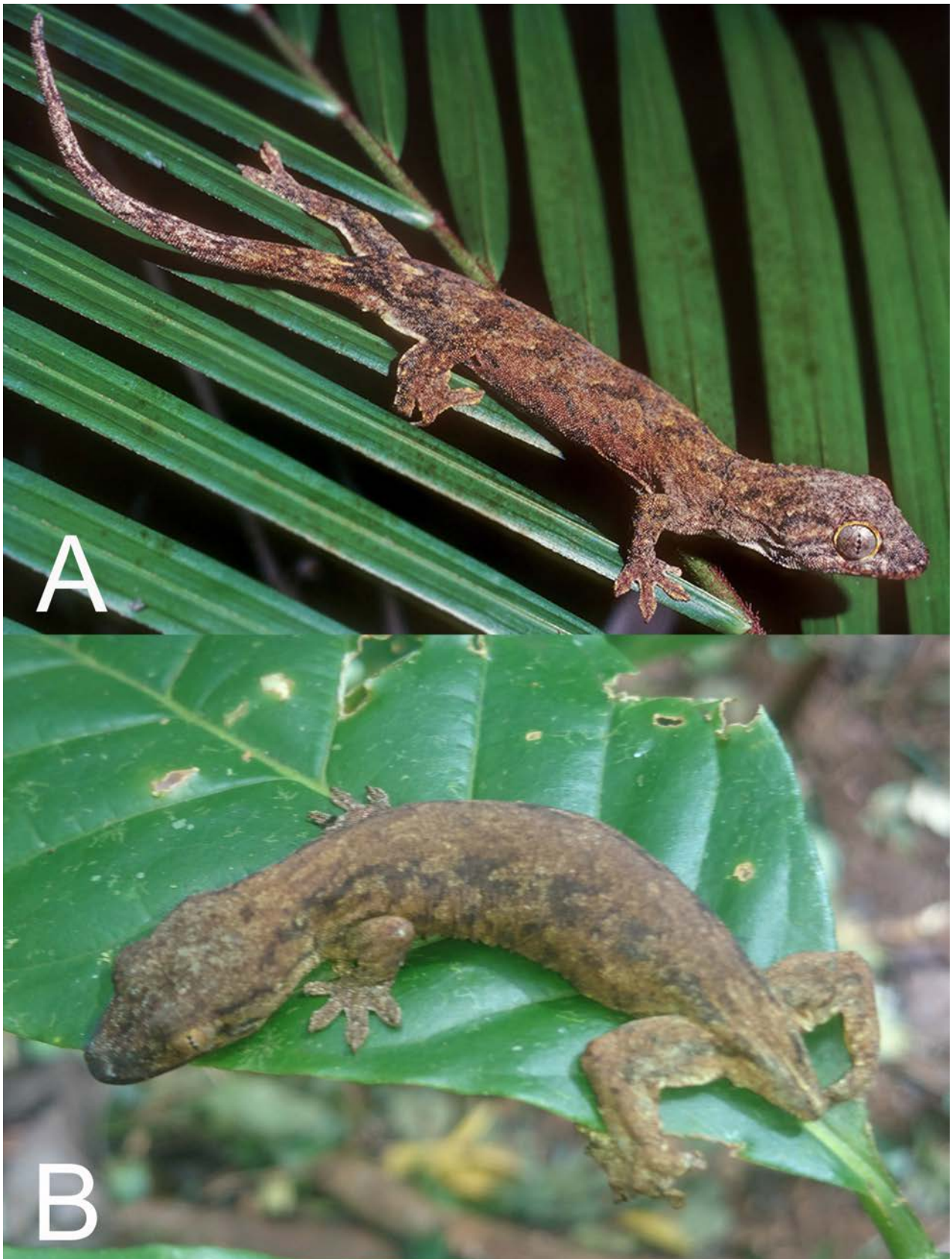


FIGURE 2. Portraits in life of (A) an individual of *Lepidodactylus flaviocularis* from near the summit of Mt. Austen, Guadalcanal, Solomon Islands; and (B) the holotype of *Lepidodactylus makira* **sp. nov.** (Ku 350843), Na'ra Village, Naepaepa Mt., Makira Island, Solomon Islands. (A) taken by M. McCoy; (B) by I. Tigulu.

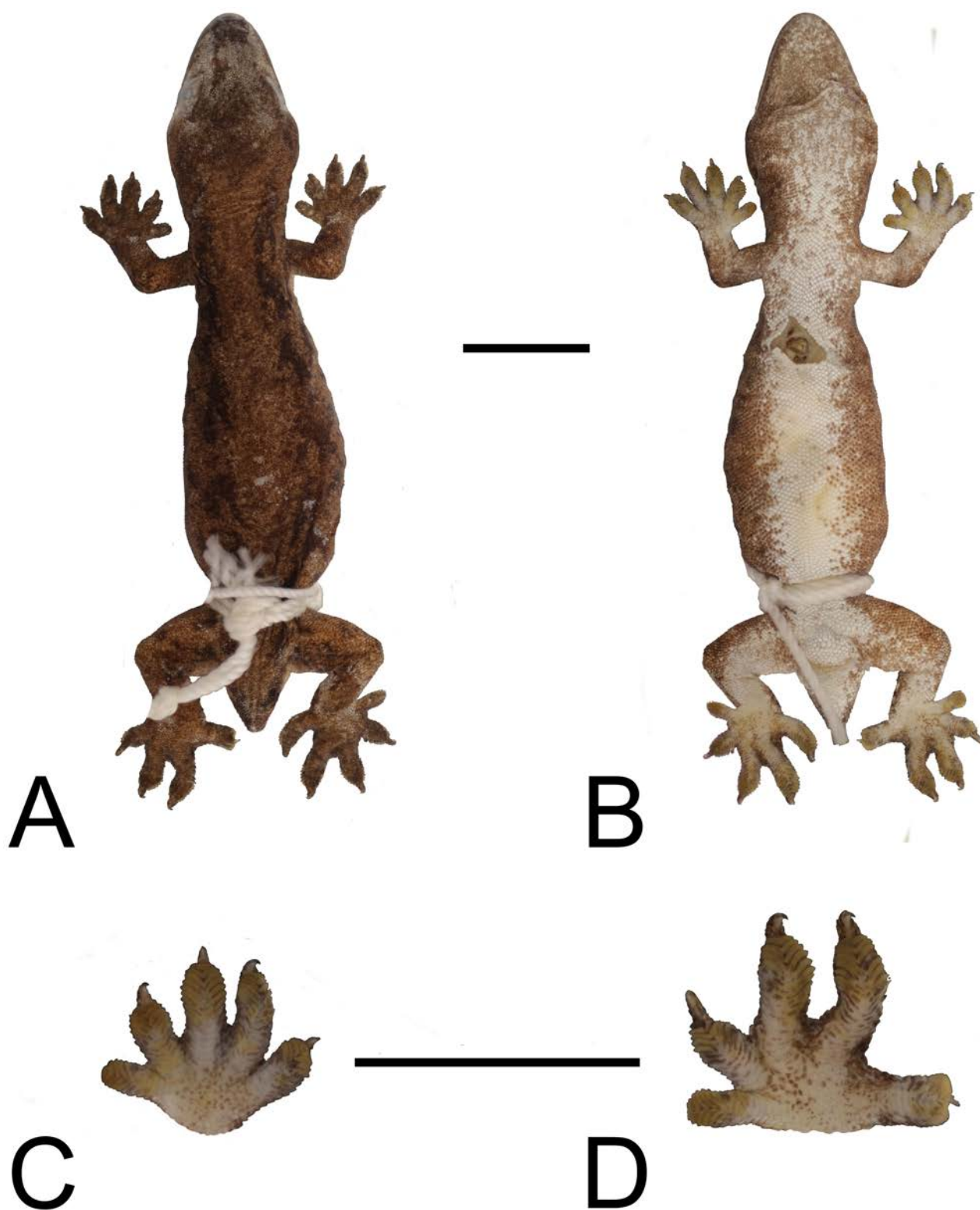


FIGURE 3. (A) Dorsum, (B) venter, (C) palmar view of left hand, and (D) plantar view of left foot of holotype of *Lepidodactylus makira* **sp. nov.** (Ku 350843), Na'ra Village, Naepaepa Mt., Makira Island, Solomon Islands. Scale bars are 1 cm.

Etymology. The species name is a noun in apposition and is named for its island of residence.

Range. Known only from two localities that are within ~15 km of each other although the paratype locality is inexact (Fig. 4).

Ecology. The holotype was collected on the leaf of a shrub ca. 2 m above ground on a ridge in thickly forested lower-montane primary rainforest (Fig. 5).

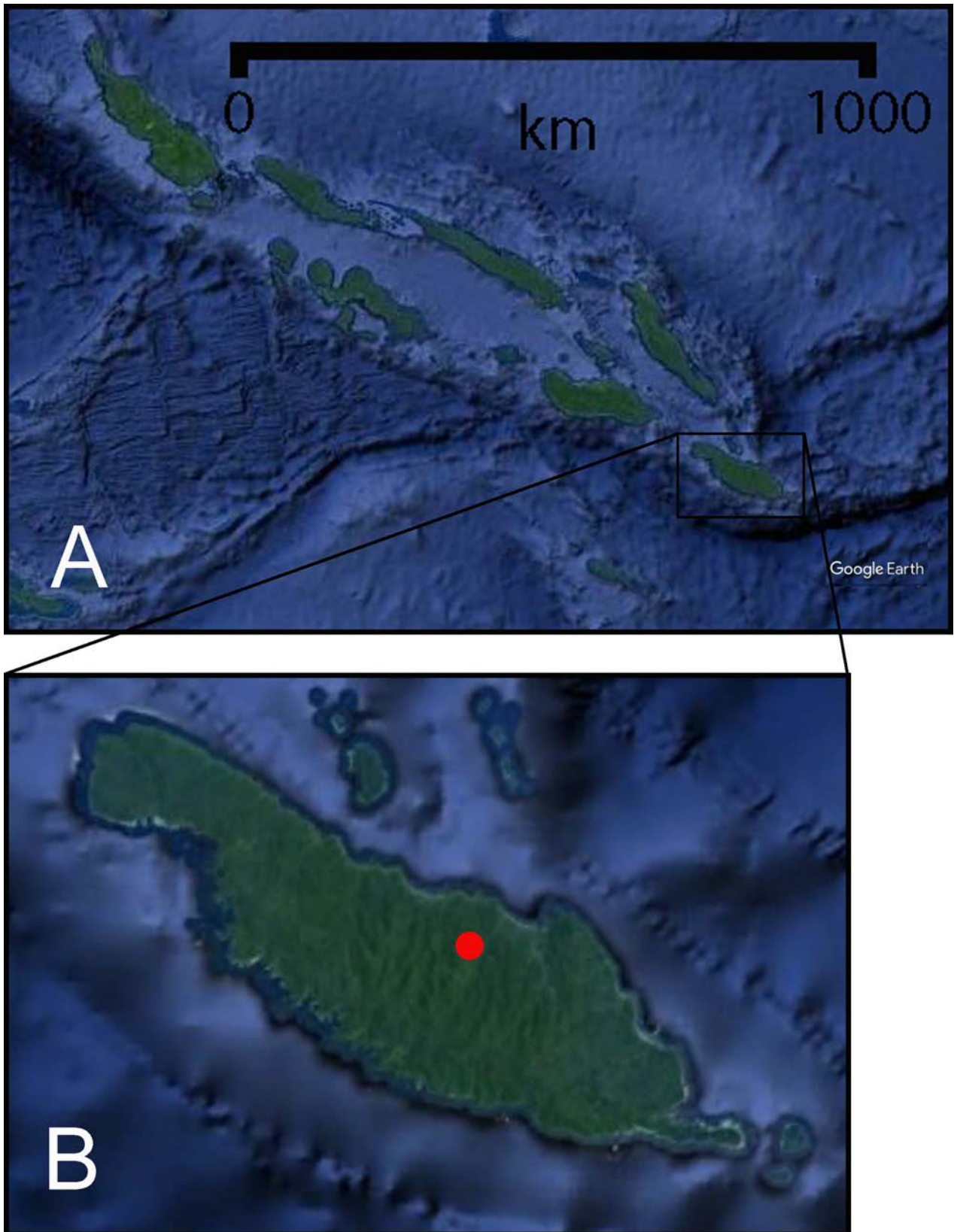


FIGURE 4. Map of (A) the Solomon Islands, with (B) Makira Island inset. r ed dot is the type locality of *Lepidodactylus makira* sp. nov.



FIGURE 5. Location where the holotype of *Lepidodactylus makira* **sp. nov.** was collected, on a ridge in lower-montane rainforest.

Remarks. *Lepidodactylus* species are often distinguished from each other in part by degree of toe webbing, with differences usually being estimated for the webbing between T3 and T4. I have found that distinction to generally work well, as it does for distinguishing *L. makira* **sp. nov.** from *L. flaviocularis*. However, for this particular species pair, the difference in degree of webbing between T4 and T5 is even more striking, and I have included it in the diagnosis for both species. As well, differences in numbers of digital lamellae are generally summarized by comparing numbers under T4 and sometimes T1. Again, those numbers well serve to distinguish *L. makira* **sp. nov.** from most other Melanesian *Lepidodactylus* but not so well from *L. flaviocularis*. However, *L. makira* **sp. nov.** does have more digital lamellae overall than does *L. flaviocularis*, and this is best captured by summing total numbers of lamellae across all digits. For *L. makira* **sp. nov.**, numbers of lamellae on each manus vary from 62–71 (mean 66.2) and each pes from 72–76 (mean 74.0), whereas those same figures for *L. flaviocularis* are 57–59 (mean 58.0) and 60–73 (mean 67.0). This better captures the impression of greater numbers of lamellae in *L. makira* **sp. nov.** even though comparisons for only T4 or T1 are less distinctive.

There may be additional differences between *L. makira* **sp. nov.** and *L. flaviocularis*, but these need to be better assessed when a broader series of each species becomes available. In preservative, the holotype of *L. makira* **sp. nov.** has dark-brown webbing between the toes, which contrasts with the paler-brown color of the surrounding scales on the feet; this stands in contrast to what is seen in *L. flaviocularis*, in which the webbing and surrounding scales are the same color and do not contrast with each other. The bleached nature of the paratype of *L. makira* **sp. nov.** does not allow me to determine whether this feature is shared by both specimens. Similarly, the iris of the holotype of *L. makira* **sp. nov.** is gold veined with brown; that of both specimens of *L. flaviocularis* appears brown instead of gold, as does the photograph in life of that species (Fig. 2A). Apparent differences in extent of webbing would also benefit from further evaluation as specimens become available, as would variation in the enlarged chin shields medial to the infralabials, which are smaller in the two specimens of *L. flaviocularis* currently available than they are in the two specimens of *L. makira* **sp. nov.**

Discussion

I serendipitously discovered *L. makira* **sp. nov.** by borrowing specimens mislabeled as *L. guppyi* in both collections holding the type series. The reason for this misidentification seems to stem from a general lack of familiarity with Brown & Parker's (1977) distinction between divided vs. undivided toe lamellae, a distinction that is not as obvious as the binary state description suggests and which was learned by me only through examining many specimens of a diversity of species. This difficulty arises in part from the necessary use by Brown & Parker (1977) of line drawings to illustrate these features, which are not detailed enough to clearly indicate some of the nuances in these features, and in part by the mislabelling of their figure 1a and 1b, which are reversed. To clarify, when Brown & Parker (1977) refer to divided lamellae they mean lamellae whose contact surface is entirely divided in the center, and this division will have the appearance of either a deep V dividing the two sides or complete separation of the brown lamellar surface with only a small amount of underlying white tissue connecting the two sides below the lamellar surface. Both of these variants can be clearly seen—in some cases on the same digit—in figure 3 of Kraus (2019) or figure 3 of Kraus *et al.* (2023). In contrast, undivided lamellae are either obviously continuous across the entire surface of the lamella (e.g., figure 2 in Kraus, 2019) or they may have shallow median notches or creases in the center, with both sides adpressed to give the superficial appearance of division, as is the case in both *L. makira* **sp. nov.** and *L. flaviocularis*. But gently teasing the two adpressed sides apart will show that the lamella is undivided across its entire surface and that the crease does not in itself denote division of the lamella. I clarify this point both because it was instrumental in the original misidentification of the *L. makira* **sp. nov.** specimens as *L. guppyi* (a species with divided subterminal lamellae) and because I know that some modern researchers on this genus have had difficulty distinguishing the two character states.

It remains to be seen what the origins and relationships are for the majority of the *Lepidodactylus* species in the Solomon Islands. In their taxonomically broad survey of relationships within the clade Oliver *et al.* (2018b) only had *L. flaviocularis* and *L. guppyi*, as well as the wide-ranging *L. lugubris*, available among the Solomon Island species. *Lepidodactylus mutahi*, *L. shebae*, and, of course, *L. makira* **sp. nov.** were lacking, but these comprise the majority of the endemic members of the genus in the Solomons. Also lacking was *L. woodfordi*, described from a single somewhat distorted specimen from Fauro Island, Solomon Islands, but which may be a senior synonym of the wide-ranging *L. pantai* (Karin *et al.* 2021). Consequently, it remains uncertain to which species *L. makira* **sp. nov.** is most closely related, though it seems likely to be sister to *L. flaviocularis*, judging both by morphological similarity and geographical proximity. It further remains to be determined whether the three Solomon endemics with undivided lamellae (*L. flaviocularis*, *L. makira* **sp. nov.**, *L. mutahi*) form a clade or whether that digital feature is plesiomorphic or has been independently derived among some of them.

The *Lepidodactylus* of the Solomon Islands present a curious situation in which all of the endemic species in that archipelago are either quite rare or inhabit cryptic habitats. All four certainly endemic species are reported from only single islands, and all but one are known from very few documented specimens ($n = 1, 2, 2,$ and 26) [note: *L. shebae* is reported on VertNet from two specimens other than the holotype, but one of these is from an island far from the type locality, and the second lacks locality data beyond “Solomon Islands”; both require taxonomic verification]. The new species, *L. makira* **sp. nov.**, and its apparently closest relative, *L. flaviocularis*, fit this pattern, each being known from only two specimens. This pattern of rarity is a repeated pattern within *Lepidodactylus* *s.l.* (McDonald *et al.* 2022), and it has often proven difficult to determine whether this paucity of specimens represents true rarity or cryptic habits, perhaps because species largely inhabit forest canopies. So far as is currently known, *L. makira* **sp. nov.** and *L. flaviocularis* have only been found in interior forest habitats, though whether they largely occupy forest canopy is unknown. What is certain is that *Lepidodactylus* lizards can be difficult to find even with targeted surveys (e.g., Kraus *et al.* 2023), and herpetofaunal surveys in Melanesia have rarely targeted *Lepidodactylus* specifically, being focused on more general sampling of a broad array of taxa. This appears to be true in the Solomon Islands as well, with each of the endemic species except *L. mutahi* simply turning up serendipitously in the course of more general survey work. In contrast, most *L. mutahi* animals—the only endemic *Lepidodactylus* in the Solomons with a good series of specimens—were obtained by Fred Parker from local villagers or during surveys of *Pandanus* swamp forest at night, suggesting that this species may have been obtained in larger numbers because it does not inhabit interior forest habitats.

The connection between apparent rarity and occupation of interior forest habitats for *L. makira* **sp. nov.** and *L. flaviocularis* is consistent with the taxon-cycle hypothesis, which predicts ecological displacement of original

inhabitants on oceanic islands to interior forests by later-colonizing relatives (Wilson 1961). Oliver *et al.* (2018b) found no support for this hypothesis among *Lepidodactylus* species inhabiting oceanic islands, though it did seem consistent with patterns on larger, continental islands like New Guinea or Borneo. In contrast, the pattern seen for *L. makira* **sp. nov.** and *L. flaviocularis* seems consistent with the taxon-cycle hypothesis. *Lepidodactylus flaviocularis* is among the more ancient lineages in the genus (Oliver *et al.* 2018b), and should *L. makira* **sp. nov.** prove sister to that species, it presumably would be too. In contrast, the unisexual species complex known as *L. lugubris* is of far more recent derivation (r adtkey *et al.* 1995; Oliver *et al.* 2018b), has been rapidly increasing its distribution around the world as a cargo stowaway (Kraus 2009), and seems to have been introduced to the Solomon Islands only in the past century (Ineich 1999; Nania *et al.* 2020). Judging from Bauer & Henle (1994) and VertNet records, it is common and widely distributed across that archipelago, including on Makira. Hence, it may be that both *L. makira* **sp. nov.** and *L. flaviocularis* are being ecologically displaced by *L. lugubris* in real time, presumably via competitive exclusion or via the reproductive advantage accruing to the parthenogen. This hypothesis has also been raised as a potential explanation for the apparent rarity of the newly described *L. laticinctus*, though that species is not strictly restricted to interior habitats (Kraus *et al.* 2023).

An alternative explanation for restriction of these lizards to interior forest habitats or their possible rarity could be impacts from other invasive alien species. Invasive rats are common throughout Makira (Mittermeier *et al.* 2018) and could potentially be limiting gecko populations through predation. That invasive predators are capable of exterminating *Lepidodactylus* populations has been shown as highly likely for *L. listeri*, although rats were not the main destructive agent in that case (Smith *et al.* 2012; Emery *et al.* 2021). In either event, it is clear that the biotic community with which *L. makira* **sp. nov.** evolved has been highly disrupted in recent centuries, and this may be having negative effects for the population dynamics of *L. makira* **sp. nov.** Given the poor sampling available for *L. flaviocularis* and *L. makira* **sp. nov.**, the uncertainty of their true rarity vs. cryptic habits, and the pressures exerted on those species by introduced predators and competitors, the conservation status of both species can only be consider Data Deficient (Iu CN Standards and Petitions Committee 2022) at present but of potential concern, as seen for many other species of *Lepidodactylus* (McDonald *et al.* 2022).

Given the paucity of specimens for all endemic Solomon Island *Lepidodactylus*, it seems likely that further survey work in that archipelago will reveal additional endemic species. Should these be discovered, their placement among the species groups identified by Oliver *et al.* (2018b) will be of interest, both for determining patterns of morphological character evolution in those lizards as well as for better assessing the degree to which the taxon cycle may explain distributions of *Lepidodactylus* species in that archipelago. More pressing is that detailed data on those species' ecological vulnerabilities is needed to more confidently assess the conservation status of each.

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