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Male secondary sexual characteristics of the gecko *Cyrtodactylus celatus* Kathriner et al., 2014 from Timor Island

(Squamata, Gekkonidae)

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We report the male secondary sexual characteristics of *Cyrtodactylus celatus* Kathriner et al., 2014 from a specimen in the Zoologische Staatssammlung München, Germany, that was heretofore unassigned to species. This second known individual of the species was collected 13 years earlier than the holotype of *C. celatus*, and thus ranks as the oldest report of the genus *Cyrtodactylus* for Timor Island. Key secondary sexual characteristics include the presence of a small precloacal groove with four (2R/2L) pore-bearing scales, and the absence of femoral pores.

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Introduction

Kathriner et al. (2014) recently defined a new species of bent-toed gecko from West Timor, Indonesia. This species, now known as *Cyrtodactylus celatus*, was described from a single specimen, an adult female (BMNH 1926.10.30.45) collected by the British physician and herpetologist Malcolm Smith in 1924 (see Smith 1927, 1947). It can be differentiated from other species of *Cyrtodactylus* in the Lesser Sunda Archipelago, including *C. darmandvillei* (Weber, 1890), *C. gordongekkoi* (Das, 1993), *C. l. laevigatus* (Darevsky, 1964), *C. l. uniformis* Auffenberg, 1980, and *C. wetariensis* (Dunn, 1927), by its small size and using a variety of pholidotic characteristics (for details, see Kathriner et al. 2014). In the last years, several additional undescribed species of *Cyrtodactylus* have been reported from Timor Island, but these are also different and can be separated from *C. celatus* by a substantially larger size or by differences in coloration and markings (see Kaiser et al. 2011, Sanchez et al. 2012, Kathriner 2015, O'Shea et al. 2015).

Several specimens of bent-toed geckos from the Sunda Region exist in the herpetological collection of the Zoologische Staatssammlung München, Germany (ZSM), which are listed as "*Cyrtodactylus* sp." and whose specific status has not been further investigated. Amongst these, the senior author discovered a specimen clearly conspecific with *C. celatus*, collected by C. B. Haniel in 1911 during the Timor Expedition led by the German geologist Johannes Wanner (Hellmayr 1913), 13 years earlier than the holotype of *C. celatus*. The collecting locality is identified as "Ofu", which we believe refers to a location now variously known as Oefau or Ofu, West Timor, East Nusa Tenggara Province, Indonesia (ca

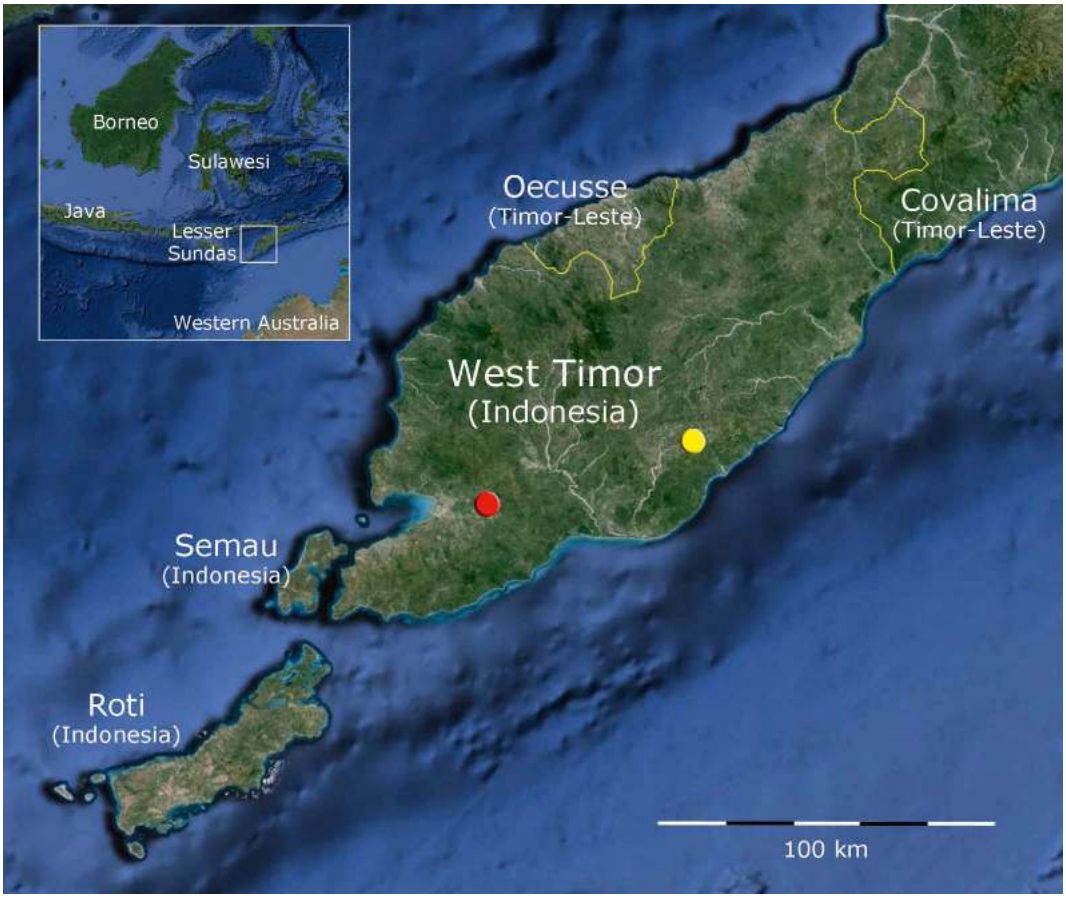

Fig. 1. Map of the Indoaustralian Region (inset) and West Timor (enlarged area). The collecting locality of the male *Cyrtodactylus celatus* (ZSM 556/2002) at Oefau (●) is ca. 63 km (by air) east of the type locality at Tjamplong (●).

9.942781° S, 124.468269° E; geoview.info), situated ca 63 km (by air) east of Tjamplong (= Camplong; 10.047961° S, 123.901422° E), the type locality (Fig. 1). The reason why this single specimen is of interest is twofold. It takes the place of Malcolm Smith's specimen as the earliest record of the genus *Cyrtodactylus* for Timor, and since it is a male, it allows the addition of some important male-specific characters to complete the diagnosis of the species.

Materials and methods

Our data were collected on ZSM 556/2002 (Fig. 2), an adult male from Ofu (elevation 800 m), West Timor, East Nusa Tenggara Province, Indonesia, collected by C. B. Haniel between 3–5 July 1911. In order to compare characters of the ZSM specimen with the holotype of *C. celatus*, we compiled a set of measurements and scale counts. All measurements were made with calipers to the nearest 0.1 mm following the methods of Bauer (2002, 2003) and Rösler & Glaw (2008). Scale counts were made using a Zeiss dissecting microscope. Pholidosis characters were counted as described by Kathriner et al. (2014). All data were taken on the right side of the specimen; in some instances both sides were scored, and this is indicated by identifying right (R) and left (L) sides.

Results

Size and body proportions. In this paragraph, we list measurements (in mm) and abbreviations (as needed) for nine dimensions on the specimen. Snout-vent length (SVL) 41.4, from tip of snout to vent; tail length (TL) 48.9, from vent to tip of original tail; head length (HL) 11.0, from tip of snout to posterior

Fig. 2. Dorsal view of the only known male *Cyrtodactylus celatus* (ZSM 556/2002). SVL = 41.4 mm.

Fig. 3. Magnified view of the precloacal area of the only known male *Cyrtodactylus celatus* (ZSM 556/2002).

margin of retroarticular process of lower jaw; head width (HW) 7.8, at the angle of the jaws; head depth (HD) 5.2, as maximum depth of head from occiput to throat; eye-snout distance 5.2, from tip of snout to anterior most margin of eye; eye-ear distance (EyeEar) 4.6, from posterior edge of ear opening to posterior margin of eye; orbital diameter (OrbD) 2.6, as maximum eye diameter; ear length (EarL) 0.8, as distance from anterior edge to posterior edge of ear. The following ratios are provided for an assessment of relative body dimensions: TL/SVL 1.18, HL/SVL 0.27, HW/HL 0.71, HD/HL 0.47, EyeEar/HL 0.51, OrbD/HL 0.24, EarL/HL 0.07.

Pholidosis. Rostral wider than tall, weakly concave above, medial suture reaching the center of the scale. Supralabial scales 8R/8L (7R/6L to the center of the eye), 1–2 scales between orbit and supralabials. Naris in contact with rostral and first supralabial; 3R/3L nasals, nasorostrals and supranasals about the same size, postnasals half as large as nasorostrals, one internasal, half as large as nasorostral, posteriorly with a single granular snout scale bordering internasal. Snout slightly concave medially, granular scales on the snout round to weakly oval, smooth, conical, twice as large as granular scales in the occipital region, 15R/13L scales between naris and orbit, 31 scales between 4th supralabials. Interorbital, parietal, and temporal region with granular scales, including small conical tubercles in the parietal and temporal regions, 30 interorbital scales, with some slightly enlarged; supraciliary scales smooth, distended, anterodorsally twice as large as posterodorsally, ear opening oblique/oval, scales in nuchal region granular, nuchal tubercles conical, twice as large as occipital tubercles. Mental triangular, as wide as rostral, 8R/8L infralabials; two 1° postmentals, trapezoid in shape, right 1° postmental slightly longer than left 1° postmental, medially in contact, five scales bordering postmentals, the outer ones (2° postmentals) enlarged, bordering 1st and 2nd infralabials; gular scales granular, as large as interorbital scales.

Dorsal and lateral scales smooth, in rows, granular, slightly larger than interorbitals, dorsal and lateral tubercles at most twice as big as occipital tubercles, generally as wide as long, conical, not or weakly keeled, 19 tubercle rows at midbody, 22 dorsal tubercles between forelimb and hind limb insertion; lateral fold without tubercles, ventral scales as large as the largest dorsal tubercles, smooth, imbricate, 37 ventrals at midbody, 157 scales between metal and cloaca; four (2R/2L) precloacal tubercles in a row, anteriorly and laterally bordered by large, smooth imbricate scales, posteriorly five small, flat, smooth, imbricate scales in three rows (2/2/1), similar in appearance to a precloacal groove (Fig. 3).

Forelimb scales on upper and lower portion anteriorly flat, smooth, imbricate, posteriorly granular, lower arm with individual, conical tubercles; hind limb scales as those on the forelimb, with tubercles on both upper and lower portions of the limb; lamellae on fingers 1–5 (R/L) 10/10, 12/12, 14/15, 15/14, 13/12; on toes 1–5 (R/L) 9/10, 12/12, ?/13, ?/17, 16/15.

Tail round in cross section, not expanded at its base, with indistinct tubercular whorls around the tail, dorsal tail scales 1.5 times the size of dorsal scales, flat to slightly rounded, smooth, in rows or subimbricate, in regular diagonal rows, nine rows on the 2nd and 10 rows on the 5th tubercular whorl; tubercles on the tail twice as long as wide, conical, keeled, pointed, proximally elongated, on the 1st whorl six tubercles in two rows (2R/4L), on whorl 2–5 four tubercles, on whorl 6–8 two tubercles in a diagonal row at the end of the whorl, dorsal tail tubercles medially separated by 2–4 scales, distal half of the tail without tubercles; at its root, the tail shows ventrally a paired expansion, which holds the hemipenes, 2R/3L postcloacal tubercles, dorsolateral

postcloacal tubercles twice as large as ventrolateral tubercles, subcaudals not transversally enlarged, medial scales three times as large as dorsal tail scales, flat, smooth, imbricate.

Coloration and patterning. Dorsally and ventrally light brown, with brown patterning (Fig. 2); head and limbs speckled dorsally, with a stripe running from the posterior edge of the orbit across the temporal region to the ear opening, three nuchal spots, two short shoulder stripes, two short sacral stripes, dorsum with four longitudinal rows of stripes, tail banded; gular, ventral, and subcaudal scales with small melanin spots.

Discussion

The male differs from the female holotype by its slightly larger SVL (41.4 mm vs. 38.4 mm) and tail length (48.6 mm vs. 44.6 mm) but with essentially identical proportions (SVL/TL 0.85 vs. 0.86). The specimen also still has its complete original tail attached, whereas the tail on the holotype has become separated from the body. All other proportions, with the exception of HW, are the same or show only minor deviations (Kathriner et al. 2014). The head of the male is proportionally wider than that of the female (HW/HL 0.71 vs. 0.57), which may be a function of more robust jaw musculature as seen in some geckos (e. g. Bauer 2013). Additional external morphological differences include paired hemipenial pockets, precloacal pores, and postcloacal tubercles.

The sexually dimorphic characteristics of the male individual of *C. celatus* are important in the recognition of sexes and species diagnosis of many *Cyrtodactylus* species. In males of *Cyrtodactylus* the base of the tail is generally enlarged (by the paired hemipenial pockets; see Smith 1935), they possess larger and more postcloacal tubercles (Rösler 2000), as well as larger precloacal, femoral, or peranofemoral pores filled with secretions (Rösler 2005), that are absent in only a few species (Rösler & Glaw 2008). Number and arrangement of these pore-bearing scales are diagnostic for individual species. *Cyrtodactylus celatus* only possesses precloacal pores, which do not form an obtuse angle. The two slightly recessed pore rows meet medially, similar to the description by Taylor (1922: 45, Fig. 1) for the Philippine species *C. annulatus* (Taylor, 1915). It is noteworthy that the five small, posteriorly following scales are positioned in a groove. These are followed by 4-5 additional rows of enlarged precloacal scales, which transition into the granular cloacal scalation. Even though Duméril and Bibron (1836) appeared to report *Cyrtodactylus* from Timor (then under the name *Gymnodactylus timorensis*), it has been discussed elsewhere (e. g. Sanchez et al. 2012, Kathriner et al. 2014, Rösler 2016) that the specimen in question actually was not collected on Timor at all. The discovery of Malcolm Smith's 1924 specimen in the British Museum, which led to the identification and description of *C. celatus*, therefore appeared to be the earliest record of the genus for Timor. The collection by C. B. Haniel in July 1911 moves this date back 13 years, and ZSM 556/2002 is therefore the oldest known record of the genus *Cyrtodactylus* for Timor.

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