Hamadryad Vol. 31, No. 2, pp. 250 – 257, 2007.

REDESCRIPTION OF THE GEKKONID LIZARD *CYRTODACTYLUS SWORDERI* (SMITH, 1925) FROM SOUTHERN PENINSULAR MALAYSIA

L. Lee Grismer[1], Perry L. Wood, Jr. and Timothy M. Youmans

Department of Biology, La Sierra University, 4500 Riverwalk Parkway, Riverside, California 92515-8247, U.S.A.
[1]Email: lgrismer@lasierra.edu

(with two text-figures)

ABSTRACT.– A redescription of *Cyrtodactylus sworderi* (Smith 1925), previously known only from an adult female with a regenerated tail, is presented based on four additional specimens (three adult females [one with an original tail] and one adult male with an original tail). The examination of an adult male and specimens with complete, original tails is particularly useful because some of the diagnostic characters separating various species of Sundaland *Cyrtodactylus* are found only in males and on original tails. New locality records are presented, extending the distribution of *C. sworderi* approximately 84.5 km to the north from the type locality near Kota Tinggi to just south of the Pahang State border in Endau-Rompin, Johor and to Jemaluang, Johor in the northeast .

KEY WORDS.– *Cyrtodactylus sworderi,* Endau-Rompin, Johor, redescription, Malaysia.

INTRODUCTION

Cyrtodactylus is rapidly becoming recognized as one of the most speciose gekkonoid genera (Kluge, 2001) with several new species being discovered and described every year (e.g., Bauer, 2002, 2003; Bauer et al., 2002, 2003; David et al., 2004; Grismer 2005; Grismer and Leong, 2005; Youmans and Grismer, 2005). Its extensive distribution from Asia to the South Pacific, ranges across the Indo-Australian Archipelago, within which the continental areas and islands of the Sunda Shelf harbour at least 24 species (Das and Lim, 2000; Grismer 2005; Grismer and Leong, 2005; Youmans and Grismer, 2005; Grismer et al., 2006; Manthey and Grossmann, 1997). Many of these species are common and widespread, yet others are endemics with extremely localized distributions (e.g., Das and Lim, 2000; Dring, 1979; Grismer, 2005; Grismer and Leong, 2005; Hikida, 1990; Inger and King, 1961; Youmans and Grismer, 2005). One such species, *C. sworderi* (Smith, 1925) was described on the basis of a single female with a regenerated tail collected approximately 20 km north of Kota Tinggi, Johor, in southern Peninsular Malaysia. As the mountainous southern regions of Peninsular Malaysia are still unexplored relative to other areas of Malaysia (see Grismer and Leong, 2005; Grismer, 2006), no recent vouchered material of *C. sworderi* had been reported subsequent to the collection of the holotype. Daicus and Hashim (2004) reported a specimen of *C. sworderi* from Lubok Tapah in the western region of Endau-Rompin, Johor, but the specimen was released (Daicus, pers. comm. 2006).

During a survey of the Peta region in the Endau-Rompin National Park, Johor, from 28 August to 1 September 2005, we observed five individuals of *C. sworderi,* three of which we were able to collect. The examination of this new material, along with a specimen from Gunung Panti, Johor and a photograph of a living specimen from Jemaluang, provides the basis for a more adequate characterization of this species. Furthermore, the examination of an adult male and specimens with original tails is particularly useful because some of the diagnostic characters separating various species of Sundaland *Cyrtodactylus* are found only in males

and on original tails. With these new data, we can now place *C. sworderi* in a broader, phylogenetic context including all other species of *Cyrtodactylus* (Bauer, Jackman, and Grismer, in prep.).

MATERIALS AND METHODS

Measurements used follow Grismer and Leong (2005) and were taken with Mitutoyo digital calipers to the nearest 0.1 mm: snout-vent length (SVL), from tip of snout to vent; trunk length (TrunkL), from posterior margin of forelimb insertion to anterior margin of hind limb insertion; crus length (CrusL), from base of heel to knee; tail length (TailL), from vent to tip of original tail; tail width (TailW), measured at widest part of tail; head length (HeadL), measured from retroarticular process of jaw to tip of snout; head width (HeadW), measured at widest part of head; head height (HeadH), measured from occiput to underside of lower jaws; ear length (EarL), taken as longest vertical dimension of ear; forearm length (ForeaL), from base of palm to elbow; orbit diameter (OrbD), measured as greatest diameter of orbit; nares to eye distance (NarEye), distance between anteriormost part of eye and nares; snout to eye distance (SnEye), measured from anteriormost point of eye to tip of snout; eye to ear distance (EyeEar), from anterior edge of ear opening to posterior edge of eye; internarial distance (Internar), taken between nares; and interorbital distance (Interorb), measured as shortest distance between left and right superciliary scale rows.

Scale counts taken were postmentals (and their degree of medial contact); supralabials, counted to midpoint of eye; infralabials; scales bordering nostril (number and types); number of longitudinal rows of tubercles counted from one side of body across dorsum to other side; number of paravertebral tubercles counted along right side of vertebral axis from midpoint of forelimb and hind limb insertions; number of ventral scales counted between ventrolateral body folds; and number of subdigital lamellae on the fourth toe.

All three specimens from Endau-Rompin are temporarily deposited in the La Sierra University Herpetological Collection (LSUHC), Riverside, California. The Gunung Panti specimen is deposited in the Raffles Museum of Biodiversity Research (ZRC), National University of Singapore, Singapore.

RESULTS

The following diagnosis and description are based on LSUHC 7685 (adult female, SVL 80 mm), LSUHC 7700 (adult male, SVL 69 mm), and LSUHC 7732 (adult female, SVL 80 mm) from the Peta region of Endau-Rompin, Johor, and ZRC 2.5505 (adult female, SVL 71 mm) from the foothills of Gunung Panti, Johor. The colour pattern description is based on LSUHC 7685, 7700, 7732 while they were alive, and on a photograph of a living specimen from Jemaluang, Johor, deposited in the La Sierra University Digital Photograph Collection (LSUDPC 900) taken and donated by H. H. Tan. The holotype was unavailable for examination due to the British Museum's overseas loan policy of type material.

Cyrtodactylus sworderi (Smith, 1925)
(Figs. 1–2)

Gymnodactylus sworderi Smith 1925. Type locality: "9 miles north of Kota Tinggi, Johore [Johor]", Peninsular Malaysia. Holotype: The Natural History Museum, London (BMNH1946.8.23.24).

Diagnosis.– Table 1 indicates that *Cyrtodactylus sworderi* can be distinguished from all other Sundaland species by having the following suite of character states: 69–80 mm SVL; large, conical, keeled, body tubercles; tubercles present on top of head, occiput, nape, and limbs, and extend posteriorly beyond base of tail; 42–49 midventral longitudinal scale rows; no transversely enlarged median, subcaudal scales; proximal subdigital lamellae transversely expanded; 18 subdigital lamellae on fourth toe; smooth transition between posterior and ventral femoral scales; no enlarged femoral scales; no femoral pores; preanal groove absent; triangular series of enlarged preanal scales with 8 or 9 preanal pores in males; banding pattern on body absent; dark brown ground colour on dorsum overlain with a series of longitudinally arranged yellow spots.

Description.– Measurements and counts of each specimen is presented in Table 2. Head

Figure 1. Preanal and femoral region of adult male *Cyrtodactylus sworderi* (LSUHC 7700).

Figure 2. Upper: light colour phase of a gravid adult female *Cyrtodactylus sworderi* (LSUHC 7732) with a complete, unregenerated tail from Sungai Semawak, Peta region, Endau-Rompin, Johor. Middle: light colour phase of a non-gravid adult female *C. sworderi* (LSUHC 7685) with a regenerated tail from Sungai Kawal, Peta region, Endau-Rompin, Johor. Lower: Dark colour phase of an adult *C. sworderi* (LSUDPC 900) from Jemaluang, Johor. Sex unknown. Photograph by H. H. Tan.

moderately long (HeadL/SVL 0.26–0.27) and wide (HeadW/HeadL 0.66–0.69), somewhat depressed (HeadH/HeadL 0.41–0.46), distinct from neck, and triangular in dorsal profile; lores weakly inflated, prefrontal region slightly concave; canthus rostralis smoothly rounded; snout elongate (SnEye/HeadL 0.41–0.43) and sharply rounded in dorsal profile; eye large (OrbD/HeadL 0.23–0.26); ear opening elliptical and small (EarL/HeadL 0.09–0.10); eye-to-ear distance greater than diameter of eye; rostral subrectangular with a deep dorsomedial furrow containing a slightly enlarged postrostral; rostral partially divided dorsally, bordered posteriorly by large left and right supranasals and three medial postrostrals (= internasal); external nares bordered anteriorly by rostral, dorsally by two supranasals, posteriorly by 3–6 postnasals and ventrally by first supralabial; 10–13 (R, L) square supralabial scales extend ventrally, and taper smoothly below posterior margin of eye; 10 (R, L) infralabial scales tapering smoothly posteriorly to below posterior margin of orbit; scales of rostrum, lores, top of head, and occiput small and granular; scales on top of head and occiput intermixed with slightly enlarged tubercles; dorsal and ventral superciliaries cone-shaped and bluntly rounded; mental triangular, bordered laterally by first infralabial and posteriorly by left and right rectangular postmentals contacting medially for approximately 20–50% of their length posterior to mental; one enlarged row of sublabials extending posteriorly to 4–6th infralabial; gular scales small and granular, grading posteriorly into slightly larger, flatter, throat scales, and into large, flat, imbricate pectoral and ventral scales.

Body relatively short (TrunkL/SVL 0.41–0.50) with weak, ventrolateral folds; dorsal scales small and granular, interspersed with large, conical, semi-regularly arranged, keeled tubercles; tubercles extending from top of head between eyes to anterior one-third of tail; tubercles on top of head, occiput, and nape relatively small, those on body largest; approximately 17–26 longitudinal rows of dorsal tubercles and 36–38 paravertebral tubercles; 40–49 flat, imbricate ventrals, which are much larger than dorsals; slightly enlarged patch of preanal scales bearing 5–9 pores, that are better developed in male; preanal groove absent (Fig. 1).

Forelimbs moderate in stature, relatively short (ForeL/SVL 0.14–0.16); granular scales

Table 1. Mensural and meristic data from Sunda Shelf species of *Cyrtodactylus* from peninsular Malaysia, Borneo, Java, and Sumatra. 1 = presence of character state, 0 = absence of character state. Data from Grismer (2005) and Grismer and Leong (2005).

	aurensis	*baluensis*	*brevipalmatus*	*cavernicolous*	*consobrinus*	*elok*	*fumosus*	*ingeri*	*lateralis*	*malayanus*	*marmoratus*	*matsuii*
SVL	92–95	72–86	64–73	64–81	97–121	56–68	71–75	65–76	85	70–73	76	105
tuberculation moderate to strong	0	1	1	1	1	0	1	1	1	1	1	1
tubercles on forelimbs	0	1	1	0	1	1	1	1	1	1	1	1
tubercles on hind limbs	0	1	1	1	1	1	1	1	1	1	1	1
tubercles on head and/or occiput	0	1	0	1	1	0	1	1	1	1	1	1
tubercles on at least 1/3 of tail	0	0	1	1	1	1	0	1	—	1	0	1
ventral scales	45–51	40–45	35–45	51–58	58–65	44	35–40	40–43	60–64	58–62	40–50	51
enlarged median subcaudals	1	1	0	0	1	0	0	1	0	1	0	0
proximal subdigital lamellae broad	1	1	1	1	1	1	1	1	1	1	1	1
subdigital lamellae on 4th toe	18–23	21–23	16–19	22–26	23–28	18–19	20–22	23–27	21–22	21–23	23-24	22
contact of posterior thigh scales abrupt	0	1	1	0	0	0	0	0	—	0	1	1
enlaged femoral scales	0	1	1	0	1	0	1	0	—	1*	1	0
femoral pores	0	6–9	6–7	0	1–6	0	42–52	0	0	0	3–10	0
preanal groove	1	0	0	1	0	0	0	0	0	0	1	0
enlarged preanal scales	1	1	1	1	1	1	1	1	—	1	1	0
preanal pores	7	9–10	9–10	4	9–10	8	42–52	8	13	8–10	12–16	7
preanal and femoral pores/scales continuous	0	0	0	0	0	0	1	0	0	0	0	0
reticulate pattern on head	1	1	0	1	1	0	0	1	0	1	0	1
body banded	1	0	0	1	1	0	0	0	0	1	0	0
body blotched	0	1	1	0	0	1	1	1	1	0	1	1
body striped	0	0	0	0	0	0	0	0	0	0	0	0

Table 1. *Continued*

	oldhami	*pubisulcus*	*peguensis*	*pulchellus*	*quadrivirgatus*	*semenanjungensis*	*seribuatensis*	*sworderi*	*thirakhupti*	*tiomanensis*	*yoshii*
SVL	63–77	59–74	85	115	51–71	59–69	75	63-80	80	84	75–96
tuberculation moderate to strong	1	1	1	1	1	1	1	1	1	1	1
tubercles on forelimbs	1	0	1	1	1	1	1	1	1	1	1
tubercles on hind limbs	1	1	1	1	1	1	1	1	1	1	1
tubercles on head and/or occiput	1	1	1	1	1	1	1	1	1	1	1
tubercles on at least 1/3 of tail	1	1	1	1	1	—	1	1	0	0	1
ventral scales	34–38	43–55	29–38	33–35	34–42	48-53	28–39	42–49	38	36–40	50–58
enlarged median subcaudals	1	0	1	1	0	0	0	0	1	0	0
proximal subdigital lamellae broad	1	1	1	1	1	1	1	1	1	1	0
subdigital lamellae on 4th toe	12–17	17–22	16–18	19–20	19–20	17-21	19–22	18	20–21	20–22	25–30
contact of posterior thigh scales abrupt	1	0	—	1	0	1	1	1	1	1	0
enlaged femoral scales	1	0	0	1	1	0	1	1	1	1	0
femoral pores	0	0	0	14–18	0	0	42–45	0	0	0	0
preanal groove	0	1	0	1	0	0,1	0	0	0	1	0
enlarged preanal scales	1	1	1	1	1	1	1	1	1	1	0
preanal pores	0–4	7–9	7–9	6–8	0–4	0	42–45	5–9	0	3–5	8–12
preanal and femoral pores/scales continuous	0	0	0	1	0	0	1	0	1	0	0
reticulate pattern on head	0	0	1	0	0	0	0	0	1	0	0
body banded	0	0	1	1	0	0,1	0	0	1	1	0
body blotched	0	1	0	0	0	0,1	1	1	0	0	1
body striped	1	0	0	0	1	0	0	0	0	0	0

Table 2. Selected counts and measurements of individuals of *Cyrtodactylus sworderi*. sn = supranasal scale; pn = postnasal scale; L = labial scale.

	LSUHC 7685 Enadu-Rompin	LSUHC 7700 Enadu-Rompin	LSUHC 7732 Enadu-Rompin	ZRC 2.5505 G. Panti
Sex	female	male	female	female
SVL	80	69	80	62.8
postmentals	2	2	2	2
degree of contact of postmetals	20%	33%	20%	50%
supralabials	13	12	12	10
infralabials	10	10	10	10
scales bordering nostril	1r, 2sn, 6pn, L1	1r, 2sn, 5pn, L1	1r, 2sn, 3pn, L1	1r, 2sn, 3pn, L1
longitudinal rows of tubercles	19	26	20	17
paravertebral tubercles	36	38	38	36
longitudinal rows of ventral scales	49	40	42	46
expanded subdigital 4th toe lamellae	7	7	6	5
narrow lamellae on 4th toe	11	11	12	13
number of preanal pores	8	8	9	5
TrunkL	34.5	28.3	40	31
CrusL	13.9	12.8	13.9	11.1
TailL	47 (reg.)	77	86	58 (reg.)
TailW	6.6	4.5	6.1	4.4
HeadL	21.7	18.3	21.6	16.5
HeadW	15	12.2	15	11.1
HeadH	9.9	7.2	8.9	7.5
EarL	2.2	1.7	2.2	1.3
ForeaL	13.3	10.7	11.1	9.8
OrbD	5	4.8	5.6	4.4
NarEye	6.7	5.8	6.7	4.9
SnEye	8.9	7.8	8.9	7.1
EyeEar	7.2	5.2	7.7	4.8
Internar	2.8	2.3	2.8	1.8
Interorb	7.3	6.2	7.2	4.4

of forearm larger than those of body and interspersed with large tubercles; palmar scales rounded; digits well-developed, inflected at basal interphalangeal joints; subdigital lamellae transversely expanded proximal to joint inflections, digits narrow distal to joints; claws well-developed, sheathed by a dorsal and ventral scale.

Hind limbs more robust than forelimbs, moderate in length (CrusL/SVL 0.17–0.19), covered dorsally by granular scales interspersed with larger tubercles and anteriorly by granular scales; ventral scales of femora flat and larger than dorsals; ventral tibial scales flat and imbricate; no enlarged femoral scales or femoral pores; dorsal and ventral femoral scales meeting smoothly on posteroventral margin of thigh; plantar scales low and slightly rounded; digits well-developed, inflected at basal interphalangeal joints; subdigital lamellae transversely expanded proximal to inflected joints, digits narrow distal to joints; 5–7 expanded subdigital lamellae and 11–13 non-expanded subdigital lamellae on right 4th toe; claws well-developed, sheathed by a dorsal and ventral scale.

Original tail widest at base, tapering to a point; dorsal scales at base of tail granular, becoming flatter posteriorly; no median row of transversely enlarged subcaudal scales; scales of regenerated tails small, granular, and not arranged in hemi-whorls; tubercles not extending onto regenerated portion of tail; 2 or 3 enlarged, blade-like tubercles at base of tail; base of tail with lateral, bulbous swellings in male (Fig. 1); all postanal scales moderately sized, flat, and imbricate.

Colouration in life (Fig. 2).– *Cyrtodactylus sworderi*, like many other gekkos, has the ability

to lighten and darken its colour pattern. When abroad at night, specimens are in their light phase, which is described below (Fig. 2:Upper and Middle). In the dark phase, the colour pattern is the same, only far less contrasting (Fig. 2:Lower).

Ground colour of dorsum dark brown; slight degree of yellowish mottling on rostrum and top of head; iris copper-coloured; upper lip white or mottled with dark brown; series of yellow spots beginning in postorbital region and extending diagonally across nape to meet on midline at the level of the forelimb insertions; spots continuing as a vertebral stripe of regularly or varying width, or as separate spots, to base of tail; less prominent series of paravertebral yellow spots extending from posterior margin of eye opening along flanks to base of tail; tubercles and some granular scales of flanks yellow, giving flanks much lighter overall appearance; ground colour of original tail nearly solid black;10–11 caudal bands on tail, anterior two or three yellow, all others white; most caudal bands encircle tail; ground colour of regenerated tail nearly uniform brown, lacking bands. Lower lip white, gular region, throat, pectoral region, belly, and underside of limbs immaculate beige; subcaudal region mottled with dark brown, especially anteriorly.

Distribution and natural history.– *Cyrtodactylus sworderi* is known only from the West Malaysian state of Johor at the southern end of the Malay Peninsula. It ranges from approximately 20 km north of Kota Tinggi in the south (Smith, 1925) to Jemaluang in the northeast and to Peta, just south of the Pahang border in Endau-Rompin, in the north. It extends west to at least Lubuk Tapah (Daicus and Hashim, 2004) in the western portion of Endau-Rompin.

All three specimens from the Peta region of Endau-Rompin were found at night on vegetation in riparian habitats within lowland dipterocarp forest. LSUHC 7685 was observed facing head-down approximately 0.75 m above the ground on the trunk of a small tree (diameter ca. 200 cm; 26 August 2005). LSUHC 7700 was found clinging to a twig, head-up, 1 m above the ground (29 August 2005). An additional individual was observed facing head down on a large tree (diameter ca. 0.5 m), ca. 5 m above the ground, and a juvenile was seen running along an earthen stream bank before escaping into a burrow. All were in the dry stream bed of Sungai Kawal. LSUHC 7732 was a gravid female with two eggs and found on a thin branch 1.5 m above the rocky stream bed of Sungai Semawak (31 August 2005).

DISCUSSION

As noted by Grismer (2005) and Grismer and Leong (2005), there has been no comprehensive phylogenetic analysis of the genus *Cyrtodactylus* and even demonstrating the monophyly of the genus has proven difficult. Thus, determining the species to which *C. sworderi* is most closely related is not possible. *Cyrtodactylus sworderi* superficially resembles *C. quadrivirgatus* and *C. semenanjungensis* (with which it is sympatric) in general aspects of colouration, body size and scale counts (Grismer and Leong, 2005:Table 1), but to hypothesize at this point, that these three species share a relationship exclusive of other *Cyrtodactylus* would be conjectural.

The presence of endemic species such as the newly discovered frogs *Ansonia endauensis* Grismer 2006b and *Ingerophrynus gollum* Grismer 2007 and the lizards *Cyrtodactylus semenanjungensis* Grismer and Leong 2005 and *C. sworderi* in the lowland rainforests of sourthern peninsular Malaysia underscore the underexplored nature of this region which is under threat from the encroachment of oil palm plantations.

ACKNOWLEDGEMENTS

For field assistance, we wish to thank Nurol Nasir and Juliana Senawi. For the access to material and photographs, we are indebted K. K. P. Lim (ZRC). We would like to thank the officials of the Environmental Planning Unit, Prime Minister's Department for permission to do research in Malaysia and for the issuance of a research permit (40/200/19 SJ.1105). Aaron Bauer provided helpful comments on the manuscript.

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Received: 20 January 2006.
Accepted: 28 March 2006.