

## A NEW SPECIES OF *DIXONIUS* (SAURIA: GEKKONIDAE) FROM SOUTHERN VIETNAM

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**ABSTRACT.** – A new species of *Dixonius* is described from Nha Trang, southern Vietnam. The new species reaches an SVL of 42.4 mm, and is diagnosable from congeneric species in showing the following combination of characters: head wider than long in adults; two supranasals in narrow contact; dark canthal stripe present, but terminating at back of head; lips unbarred; and dorsum of body and tail brownish olive, with dark blotches.

**KEY WORDS.** – *Dixonius vietnamensis*, new species, systematics, Reptilia, Sauria, Nha Trang, Vietnam.

### INTRODUCTION

*Dixonius* was established by Bauer et al. (1997) for Asian gekkonids formerly placed in the genus *Phyllodactylus*, on the basis of morphology and its disjunct distribution. Rösler (2000) and Kluge (2001) recognised two species within the new Asian genus: *melanostictus* Taylor, 1962 (type locality: “Mauk Lek Road-Camp (Friendship Highway), Sara Buri” [14° 35’N; 101° 05’E; eastern Thailand; spelling of type locality emended to Muak Lek by Taylor, 1962: 218]; FMNH 178231 (holotype) and FMNH 178232 (paratype) and *siamensis* Boulenger, 1898 (type locality: “Dung Phya Fai, Siam...at an altitude of 700 feet” = Dong Paya Fai Mountains, 14° 30’N; 101°–102° 40’E, Sara Buri and Nakhon Ratchasima Provinces, eastern Thailand, mostly protected as Khao Yai National Park and Tap Lan National Park; BMNH 1946.8.24.40–41; two syntypes; and “Siam” [= Thailand]; BMNH 97.3.31.1–2; two syntypes).

Malcolm A. Smith (1930: 20, 1935: 81) treated two other names, *paviei* Mocquard, 1904, and *burmanicus* Annandale, 1905, as synonymous with *siamensis*. The holotype of *paviei*, is from “Vatana” (= Chaeng Wattana, ca. 13° 45’N, 100° 31’E: a northern suburb of Bangkok, across the highway from the airport, Phra Nakhon Province, Thailand is MNHN 1885.349; Brygoo, 1990). The holotype of *burmanicus*, reported to be in “Calcutta” (= Indian Museum Reptile Registry, the collection now accessioned with the ZSI, Kolkata, India) by M. A. Smith (1935), and collected at “Tavoy” (at present Dawei, 14° 04’N, 98° 12’E, Taninthayi State, southern Myanmar), is at present untraced in the collection of the ZSI (Das et al., 1998). These synonymies have been followed by subsequent workers (e.g., Wermuth, 1966; Kluge, 1993, 2001). Nonetheless, additional species

remain to be recognised within this genus, as colour variation, reported by Taylor (1963; see also Chan-Ard et al., 1999) and genetic evidence provided by Ota et al. (2001) suggest. Indeed, most recently, Bauer et al. (2004) described a third species, *hangseesom*, from “near Ban Tha Sao (Sai Yok Noi Waterfall), 14°06’N 99°25’E” (CUZM R 2003.58, holotype; CUZM R 2003.57; 60, 6; three paratypes); and “Thailand, Kanchanaburi Province, Sai Yok National Park” (ZMB 65437, paratype), Sai Yok District, Kanchanaburi Province, Sai Yok District.

The genus *Dixonius* has also been reported from Vietnam in the literature. Tirant (1904) presented what was known of the saurofauna of Indo-China at the time, but did not list this taxon. Nguyen and Ho (1996: 17) reported *siamensis* from “Gia Lai (Chú Sê)” (13° 59’N, 108° 00’E), presumably following the concept of Taylor (1963: 753), as did Bobrov (1992, 1993, 1995), who reported the species as occurring in South Annam, although it is unclear whether specimens were actually examined.

I report here a fourth species of the genus *Dixonius* from the eastern coast of southern Vietnam on the basis of two adults and two hatchlings. Generic allocation follows Bauer et al. (1997), who diagnosed *Dixonius* as showing the following suite of characters: digits bearing a single pair of enlarged terminal scanzors; dorsal scalation tuberculate; tubercles keeled longitudinally; granules on snout larger than those on dorsum of body; rostral scale with median cleft; first supralabial enters nostril; enlarged chinshields and lateral gulars; margins of pupil crenellate (in preserved specimens); preanal pores present; series of cloacal spurs present; and midventral row of transversely enlarged caudal scales.

## MATERIALS AND METHODS

The type series was hand-collected, photographed in life (Fujichrome Velvia 50 ASA slide transparency film), and fixed in formalin, before storage in ethanol. Notes on live colour are from colour swatches of F. B. Smith (1975, 1981).

The following measurements on the left side of the body were taken with Mitutoyo™ dial calipers (to the nearest 0.1 mm): snout-vent length (SVL: from tip of snout to vent); tail length (TL: from vent to tip of tail); tail width (TW: measured at base of tail); body width (BW: greatest width of torso, taken at level of midbody); head length (HL: distance between posterior edge of last supralabial and snout-tip); head width (HW: measured at angle of jaws); head depth (HD: maximum height of head, from occiput to throat); ear length (EL: length along the major axis of ear); forearm length (FA: distance between the palm and elbow); eye diameter (ED: greatest diameter of orbit); eye to nostril distance (E-N: distance between anteriormost point of eyes and nostrils); eye to snout distance (E-S: distance between anteriormost point of eyes and tip of snout); eye to ear distance (E-E: distance from anterior edge of ear opening to posterior corner of eyes); internarial distance (IN: distance between nares); and interorbital distance (IO: shortest distance between orbits).

Scale counts were made on the left limbs, and external observations of morphology were made using an Olympus SZX9 dissecting microscope. Midbody scale rows (MD: number of longitudinal scale rows counted midway between axilla and groin); paravertebral scales (PV: number of scales in a paravertebral row from first scale posterior to parietal scale to last scale at the level of vent opening); lamellae under toe (T4: number of scales from the distal one containing claw to basal one, that broadly contacts adjacent fragmented scale); and interorbital scales (IO: scales between supraciliaries at midpoint of orbit).

Sex of the two adult types was determined on the basis of the presence of hemipeneal swellings, complimented with the presence of preanal pores, here considered indicative of males. Sources of information on character states and distribution include Boulenger (1912), M. A. Smith (1935), Taylor (1962, 1963), Grossmann et al. (1996), Bauer et al. (1997), Cox et al. (1998), and Bauer et al. (2004). Institutional abbreviations follow Leviton et al. (1985). These include: Natural History Museum, London, U.K. (BMNH\*), Chulalongkorn University Museum of Zoology, Bangkok, Thailand (CUZM), Field Museum of Natural History, Chicago, U.S.A. (FMNH\*), Musée National d'Histoire Naturelle, Paris, France (MNHN\*), Zoologisches Museum Berlin, Berlin, Germany (ZMB\*), Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC; the abbreviation used in Leviton et al., 1985, is USDZ\*), and Zoological Survey of India, Kolkata, India (ZSI\*).

## SYSTEMATICS

### *Dixonius vietnamensis*, new species

(Figs. 1, 2)

**Material examined.** – Holotype - ZRC 2.6024, from Nha Trang (12° 15'N, 109° 10'E; 2 m ASL), Tinh Khanh Hoa Province, Vietnam, male, coll. I. Das, 8 Mar.2004.

Paratypes – ZRC 2.6025, paratopotype, male; other data as for holotype, except collected 10 Mar.2004; ZRC 2.6026–27, two paratopotypes, other data as for male paratype, except hatchlings.

**Diagnosis.** – A medium-sized species of *Dixonius* (SVL to 42.4 mm), diagnosable from congeneric species in showing the following combination of characters: head wider than long in adults; two supranasals in narrow contact; dark canthal stripe present, but terminating at back of head; lips unbarred; and dorsum of body and tail brownish olive, with dark blotches.

**Description of holotype.** – A medium-sized species of *Dixonius* (SVL 40.8 mm); snout short (HL/SVL ratio 0.18), fairly wide (HW/SVL ratio 0.19), depressed (HD/HL ratio 0.73), head distinct from neck; lores and interorbital region rounded; forehead not concave; snout relatively short (E-S/HW ratio 0.54), longer than eye diameter (ED/E-S ratio 0.67); scales on snout and forehead rounded, smooth; scales on snout larger than those on occipital region; small scales on occipital region intermixed with larger, keeled scales; interorbital scales 10; eyes large (ED/HL ratio 0.39); orbits of eyes lacking 'extra-brillar fringes' (of Underwood, 1954); canthus rostralis prominent; pupil vertically elliptical, with crenelated edges; a few elongate supraciliaries, lacking spines on anterior of top half of orbit; ear-opening deep, oval, with major axis vertically (EL/E-S ratio 0.23); ears lacking enlarged lobules; eye to ear distance greater than diameter of eyes (E-E/ED ratio 1.3); no ridge of tubercles along mandible or from posterior edge of orbit to postero-ventral edge of tympanum, or from antero-dorsum of tympanum to nape; rostral rectangular, partially divided by a simple, straight rostral groove which fails to meet anterior of snout (rostral groove running for ca. 40% of rostral depth); rostral over half as deep as wide (rostral width = 2.1 mm, rostral depth = 1.4 mm; width/depth ratio 1.5); contacted posteriorly by nostrils and two tear-drop-shaped supranasals that are in narrow contact ventro-posteriorly with supralabial I; nostrils oval, situated within nasals, oriented laterally; nostril in contact with supralabial I; two postnasals bound nasal; a single scale row separating orbit from supralabials; supralabials 7; supralabial V in midorbital position; infralabials 6; mental subtriangular, almost as deep as wide; postmentals paired, rectangular, smaller than mental and in contact; posteriorly, each postmental is bounded by three smooth, rounded, juxtaposed scales, of these scales, the outer largest; postmentals ca. 4 times larger than adjacent throat scales; tongue narrowly elongate, with a weak median cleft; no enlarged endolymphatic sac extracranially.

Body cylindrical, relatively stout, somewhat elongate (A-G/SVL ratio 0.51), lacking ventrolateral fold; scales on dorsum and flanks keeled, eight rows on each side, separated by a single row of smaller scales; smallest scales on dorsum, arranged along the vertebral region in a row of four; on flanks, scales juxtaposed, and losing their keels, grading into large, smooth, imbricate ventrals, in 20 rows; each with distinct but minute serration posteriorly; scale size gradually increasing from chin to gular, pectoral and abdominal regions; dorsal scales at midbody subequal to ventral scales; midbody scale rows 34; paravertebral scale rows 36; each scale on manus or pes smooth, rounded; scales on inner surface of fore- and hind limbs smooth; those on outer surface of fore- and hind limbs uncarinate; keeled tubercles on outer surfaces of thighs; conical tubercles on outer surface of shanks; preanal groove absent; preanal depression present; preanal pores 6 in number, in an angular series, lacking diastema; pore-bearing scales not enlarged relative to adjacent scales.

Forelimbs moderately short, stout; forearm short; hindlimbs relatively short; tibia short (TBL/SVL ratio 0.19); digits relatively short, flattened, all clawed; each digit with leaf-like lamellae at tip; a small retractable recurved claw inside digital tip; distal phalanges not elevated; subdigital scansors subrectangular, entire, unnotched; basal subdigital lamellae narrow; terminal scansors ca. 1.6 times as wide as mid-digital toe width, numbering on manus I (7); II (8); III (10); IV (10); and V (6); and on pes I (10); II (12); III (12); IV (13); and V (11); interdigital webbing absent; relative length of digits (finger): III > II > IV > V > I; (toe): III > IV > V > II > I; limbs covered with uniform, flattened, subimbricate scales.

Partially regenerated tail cylindrical, relatively short (terminal 28.3 mm regenerated), shorter than snout-vent length (TL/SVL ratio 0.93); tail tip acute, postanal hemipeneal bulge distinct; the original portion of tail weakly segmented, with five transverse rows of scales in each tail segment; paired postcloacal spur, comprising three rounded, flattened scales; regenerated portion of tail with uniform, smooth, flattened subimbricate dorsal scales; tail lacking a distinct pair of furrow laterally; median subcaudal series transversely enlarged, smooth; scales on postanal region and at proximal part of tail base smaller than on rest of tail.

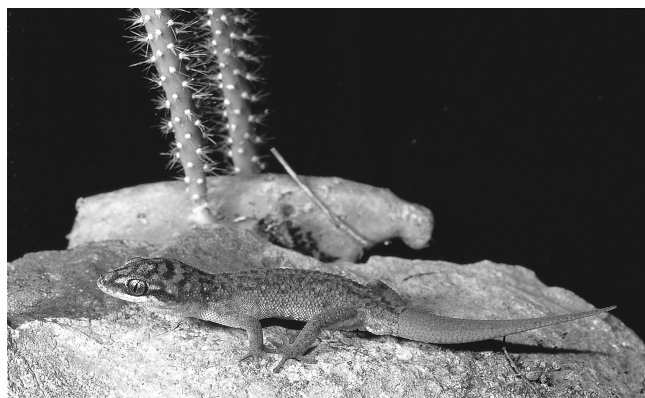


Fig. 1. Holotype of *Dixonius vietnamensis*, new species (ZRC 2.6024) in life, showing entire body.

**Colouration.** – In life, dorsum of holotype (Fig. 1) Olive-Gray (# 42) with Brownish Olive (# 29) blotches, a stripe of the same colour running from rostrum, through eyes, curving up to nearly meet two broken bands of the same colour in occipital region; dorsal surface of fore limb and hind limb Vinaceous (# 3), the latter with darker blotches; a cream stripe in canthal and postocular region; iris black with Sulphur Yellow (# 57) pupil; venter cream; regenerated tail Sayal Brown (# 223C). In preservative, dorsum light grey with irregular dark grey-brown blotches on forehead and body; colouration of tail and on dorsal surfaces of fore- and hind limbs similar but with less contrast; interorbital region of hatchlings dark grey; supralabials and infralabials with weak blotches; dark grey-brown canthal and postocular stripes, the latter extending slightly beyond level of ear; ventral surfaces of body and tail, cream with fine mottlings; undersurfaces of manus and pes grey.

**Other Variation.** – In ZRC 2.6027, the supranasals are separated by a small granule. The two juvenile paratypes (Fig. 2) were similar in colouration to the holotype, but with reduced contrast. In addition, they showed scattered Orange Yellow (# 18) tubercles on the nape and along the body, and the pupils were black, edged with Spectrum Yellow (# 17). The dark postocular stripes joined at the back of the head to form a nuchal loop in ZRC 2.6025. Scalation and measurement data are in Tables 1-2.

**Etymology.** – Latin implying an inhabitant of Vietnam.

**Natural history notes.** – The type series was collected between 8 and 10 March 2004, from rocky substrate within a disturbed coastal forest, at an elevation of 2 m ASL. The area lies within the compounds of a hotel resort, and the actual sites of collection were rock walls, that sometimes bordered paved footpaths (Fig. 3). Two of the paratypes are hatchlings (small body size; relatively large head; presence of umbilical scar; interorbital region dark grey from reduced ossification of cranium; and difference in colouration from the two adults; see ‘Other variation’), suggesting that pipping time of hatchlings coincides with the post-Northeast Monsoons (between February and March). The new species was found active between 1900–2230 h in such microhabitats.



Fig. 2. Paratype of *Dixonius vietnamensis*, new species (ZRC 2.6027) in life, showing juvenile colour pattern.

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Table 1. Squamation data of the type series of *Dixonius vietnamensis* new species. See text for details. Abbreviations: + = present; - = absent; M = male; F = female; SL = supralabial; IL = infralabial; IO = interorbital; T4 = lamellae under toe IV of pes; MV = midventral; PA = preanal depression; PP = preanal pores.

	ZRC 2.6024 (holotype) ex-ID-8086	ZRC 2.6025 (paratype) ex-ID-8087	ZRC 2.6026 (paratype) ex-ID-8088	ZRC 2.6027 (paratype) ex-ID-8089
sex	male	male	hatchling	hatchling
SL (MO)	5	5	5	6
IL	6	6	6	7
IO	10	9	8	8
T4	13	13	13	13
MV	20	20	20	20
PA depression	+	+	+	+
PP	6	5	-	-

Table 2. Measurements (in mm) of the type series of *Dixonius vietnamensis*, new species. See text for details. Abbreviations: O = original tail; R = regenerated tail; SVL = snout-vent length; TL = tail length; FA = forearm length; TBL = tibia length; A-G = axilla to groin distance; HL = head length; HW = head width; HD = head depth; ED = eye diameter; E-E = eye to ear distance; E-S = eye to snout distance; E-N = eye to nostril distance; IO = interorbital distance; EL = ear length; and IN = internarial distance.

	ZRC 2.6024 (holotype) ex-ID-8086	ZRC 2.6025 (paratype) ex-ID-8087	ZRC 2.6026 (paratype) ex-ID-8088	ZRC 2.6027 (paratype) ex-ID-8089
SVL	40.8	42.4	26.6	25.9
TL	37.8	36.2	2.5 +	12.3
TW	5.2	4.9	2.9	2.3
BW	8.0	9.1	5.4	4.0
FA	5.6	6.2	4.4	4.0
TBL	7.7	7.2	4.4	4.6
A-G	21.0	21.0	13.0	11.8
HL	7.5	7.5	5.4	5.2
HW	7.9	7.6	5.2	5.1
HD	5.5	6.0	4.0	3.3
ED	2.9	2.9	2.1	1.8
E-E	3.8	4.0	2.5	2.2
E-S	4.3	4.6	3.0	3.5
E-N	3.2	3.7	2.2	2.3
IO	3.6	3.6	2.7	2.1
EL	1.0	1.1	0.6	0.6
IN	2.1	1.6	1.1	0.9
Tail	half regenerated	nearly fully regenerated	detached in full	half regenerated



Movements were rapid, and at the signs of danger, they retreated into cracks inside stone walls. Tails of the new species apparently autotomise easily, as none of the preserved specimens in the type series show original tails, both adult types had regenerated tails (one autotomised a second time), and both hatchlings lost their tails during capture, possibly on account of stress, even though the tails were not touched during capture. In each specimen, red-coloured mites of an indeterminate species were recovered from within the lamellae. Other reptiles found in sympatry include: *Cosymbotus craspedotus*, *C. platyurus*, *Gekko gecko*, *Gehyra mutilata*, *Hemidactylus frenatus*, and *Trimeresurus albolabris*.

**Remarks.** – The new species from Nha Trang is compared with the three congeneric species, now considered valid (see Kluge, 2001: 8; Bauer et al., 2004).

*Dixonius hangseesom* Bauer, Sumontha, Grossmann, Pauwels & Vogel, 2004 (distribution: western Thailand), tail orange (vs. olive grey); dorsum with dark transverse bands (vs. with dark blotches); supranasals in broad contact anteriorly (vs. in narrow contact); *D. melanostictus* Taylor, 1962 (distribution: eastern Thailand and Vietnam; see Bobrov, 1992), dorsum patternless (vs. with dark blotches); canthal stripe extends along flanks (vs. terminates at back of head); and *D. siamensis* Boulenger, 1898 (distribution: eastern Thailand, southern Myanmar, Laos, and possibly Cambodia; see Stuart, 1999), head longer than broad (vs. broader than long, in adults); canthal stripe absent (vs. present); ear ca. half eye diameter (vs. ca. one third eye diameter); supranasals separated by two granules (vs. in narrow contact); lips strongly barred (vs. unbarred); and larger adult size–SVL up to 57.0 mm (vs. up to 42.4 mm).

Two names, now in the synonymy of *Dixonius siamensis* Boulenger, 1898 are here considered, given the genetic data that show variation within species of *Dixonius*: the first, *Phyllodactylus burmanicus* Annandale, 1905, differs from the new species in lacking cantal stripes; supralabials six (vs. seven); preanal pores seven (vs. six) and large size, the holotype reportedly 78 mm; the second species,

*Phyllodactylus paviei* Mocquard, 1904, differs from the new Vietnamese species in lacking canthal stripe; in having barred lips; two (vs. three) pairs of postmentals; and lamellae under toe IV 15 (vs. 13).

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Fig. 3. Rock wall habitat of *Dixonius vietnamensis*, new species at Nha Trang, Vietnam.

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