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A new species of the genus *Gonatodes* Fitzinger, 1843 (Reptilia: Sphaerodactylidae) from central Guyana, northern South America

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Abstract

A new sphaerodactyl lizard of the genus *Gonatodes* Fitzinger, 1843 is described from the Iwokrama Forest Reserve, central Guyana, Guiana Shield, northern South America. The new species, *Gonatodes timidus* sp. nov., is known so far from the type locality only, at ca. 210 m elevation. The new taxon is mainly distinguished from all known congeners by the following combination of characters: moderate body size, absence of a clearly differentiated elongate supraciliary spine, absence of clusters of distinctly enlarged conical scales on sides, escutcheon scales on posterior belly and ventral surfaces of thighs in males evident, three to four lateral rows of scales on distal part of fingers and toes, medial subcaudal scales distinctly differentiated from adjacent scales on non-regenerated tail (in a 1'1" sequence), and obvious sexual dichromatism, the males having the upper surface of the head black with bluish white to vivid yellow irregular stripes and blotches.

Key words: Endemism, Guiana Shield, Iwokrama, lizard, taxonomy

Introduction

The Neotropical genus *Gonatodes* currently contains 27 described species (Rojas-Runjaic *et al.* 2010, Schargel *et al.* 2010, Sturaro & Ávila-Pires 2011), of which nine (33%) have been described in the last seven years. As pointed out by Schargel *et al.* (2010) species richness in *Gonatodes* probably remains largely underestimated. Many *Gonatodes* species are apparently rather widespread, but restricted endemic species might not be uncommon in the genus. Six *Gonatodes* species are known to occur in the Guiana Shield, five of them being endemic to the area and apparently forming a monophyletic group together with a southwestern Amazonian species (see Schargel *et al.* 2010 for details).

All species, except one (the recently described *Gonatodes lichenosus* Rojas-Runjaic, Infante-Rivero, Cabello & Veloza, 2010) are strongly sexually dichromatic, and male ornamentations have been shown to be a useful character to separate species, even if variation in male colour and pattern has been recently documented (Schargel *et al.* 2010). All *Gonatodes* species are diurnal and non-vocalizing, except *G. antillensis* (Lidth de Jeude, 1887), in which nocturnality and ability to vocalize evolved secondarily according to Schargel *et al.* (2010).

The Iwokrama Forest Reserve located in central Guyana was intensively and extensively surveyed for amphibians and reptiles, mainly between May and August 1997 (Donnelly *et al.* 2005a, b). Those surveys resulted in the collection of about 2000 specimens of amphibians and reptiles (Donnelly *et al.* 2005a). Three scientific publications followed these investigations (Donnelly *et al.* 2005a, b, Wake & Donnelly 2010), and although no less than 11 putative new species were reported only one new taxon has been published to date (*Caecilita iwokrama* Wake & Donnelly, 2010). Among these 11 putative taxa is a *Gonatodes* that was reported as "*Gonatodes* sp." (Donnelly *et al.* 2005a, b), but, because no morphological data on that species have never been published, it remains uncertain whether these specimens belong to *G. alexandermendesi* (described from central Guyana in 2006 by Cole & Kok), or to another species, or both.

Recent investigations in the Iwokrama Mountains in the Iwokrama Forest Reserve led to the collection of *Gonatodes alexandermendesi* as well as a series of distinctive *Gonatodes* specimens that could not be assigned to any described species. The new taxon is described below.

Material and methods

Specimens were collected by hand and euthanized by intra-peritoneal injection of 2% Xylocaine. Tissue (a piece of tail or thigh muscle) was removed from most specimens and preserved in 95–100% ethanol. Whole individuals were fixed in 10% formalin and later transferred to 70% ethanol for permanent storage. Specimens have been deposited in the collections of the Institut Royal des Sciences Naturelles de Belgique (IRSNB); tissue samples were deposited in the Amphibian Evolution Lab, Biology Department, Vrije Universiteit Brussel (VUB) (see Appendix for material examined).

Coordinates and elevations were acquired using a Garmin 60CSx Global Positioning System unit and referenced to map datum WGS84.

Terminology for morphological characters mostly follows Rivero-Blanco (1979) and Ávila-Pires (1995). Scales counts were taken according to Cole and Kok (2006). All morphometric data were taken from the preserved specimens to the nearest 0.01 mm and rounded to the nearest 0.1 mm, under a Leica stereo dissecting microscope using an electronic digital calliper. For ease of comparison, the description mainly follows the pattern of the most recent descriptions in the genus (*e.g.* Rivas & Schargel 2008, Schargel *et al.* 2010, Rojas-Runjaic *et al.* 2010). The following measurements were taken and abbreviated as follows: (1) snout-vent length, from tip of snout to posterior margin of vent (SVL); (2) tail length, from posterior margin of vent to tip of tail (TL); (3) head length, from tip of snout to anterior margin of ear opening (HL); (4) greatest width of head (HW); (5) eye to nostril distance, from posterior margin of naris to anterior corner of eye (EN); (6) snout length, from tip of snout to posterior margin of upper postnasal scale (SL); (7) axilla-groin distance, from base of forelimb to base of hindlimb (AXG); (8) Toe IV length, from insertion of toe into the foot to the tip of the claw (ToIV); (9) shank length, from outer edge of flexed knee to a point just medial to base of fifth toe (ShL).

Colour pattern in life was taken from field notes and colour digital photographs. Sex was determined by the presence/absence of escutcheon scales and obvious sexual dichromatism.

Comparisons of external character states are based both on original descriptions and examination of museum specimens (see Appendix for material examined).

Taxonomy follows Gamble *et al.* (2008). Institutional acronyms follow Frost (2011).

New species description

Gonatodes timidus sp. nov.

(Figs. 1–4, Table 1)

Holotype. IRSNB 2664 (field number PK 3555), an adult male collected by Philippe J. R. Kok, 22 March 2011 at 15h00, base of Iwokrama Mountains, Potaro-Siparuni District, Guyana (04° 19' 52"N, 058° 47' 58"W, 209 m elevation).

Paratypes (n=9). two adult males (IRSNB 2665–66, field numbers PK 3538, PK 3557), four adult females (IRSNB 2667–70, field numbers PK 3539–41, PK 3556), two juveniles (IRSNB 2671–72, field numbers PK 3522–23) with same data as holotype, collected between 19 to 23 March 2011, and one juvenile (IRSNB 2673, field number PK 3553) collected by M. Wilkinson, 21 March 2011 in early afternoon, base of Iwokrama Mountains, opposite side of river of Tortoise camp (04° 19' 48"N, 058° 47' 54"W, 225 m elevation).

Etymology. The specific name is considered a noun in apposition and is derived from the Latin adjective *timidus* meaning “shy” or “fearful”. It refers to the tendency of individuals of the new species to avoid to be seen by hastily escaping between rocks, making them very difficult to collect.

Definition and diagnosis. The new species differs from all known congeners by the following unique combination of characters: (1) moderate body size, with adult males ranging from 46.0–46.9 mm SVL, and adult females

from 44.1–51.6 mm SVL; (2) absence of a clearly differentiated elongate supraciliary spine; (3) absence of clusters of distinctly enlarged conical scales on sides; (4) 89–97 scales around midbody; (5) 46–50 ventral scales counted in a longitudinal row; (6) escutcheon scales on posterior belly and ventral surfaces of thighs in males evident; (7) three to four lateral rows of scales on distal part of fingers and toes; (8) medial subcaudal scales distinctly differentiated from adjacent scales on non-regenerated tail, the pattern of scales consisting in repetitive series of a single midventral scale in contact laterodistally with one scale per side followed by a single midventral in contact with two scales per side (1'1" *sensu* Ávila-Pires 1995); (9) sexual dichromatism obvious, males with upper surface of head black with bluish white to vivid yellow irregular stripes and blotches, and underside of head orange, females lack any colourful head ornamentation, but usually have two thin, black-edged white crescent-shaped collars on the neck region, and the underside of head black with bluish white reticulation.



FIGURE 1. *Gonatodes timidus* sp. nov. in life. Top: Male holotype (IRSNB 2664, 46.9 mm SVL). Middle: Male paratype (IRSNB 2665, 46.7 mm SVL). Bottom: Female paratype (IRSNB 2667, 51.2 mm SVL). Note the conspicuous difference in the colour of head ornamentation between the two males, and the sexual dichromatism.

Compared to the six *Gonatodes* species known to occur in the Guiana Shield, *Gonatodes timidus* is readily distinguished by its radically different male pattern and colouration. It further differs from *G. alexandermendesi* Cole and Kok, 2010, *G. astralis* Schargel, Rivas, Makowsky, Señaris, Natera, Barros, Molina and Barrio-Amorós, 2010, and *G. superciliaris* Barrio-Amorós and Brewer-Carias, 2008 by the absence of a distinctly elongate supraciliary spine (present in *G. alexandermendesi*, *G. astralis* and *G. superciliaris*), from *G. annularis* Boulenger, 1887 by having the medial subcaudal scales distinctly differentiated from adjacent scales on non-regenerated tail (not distinctly differentiated in *G. annularis*) and a dark copper coloured iris in males (always blue in *G. annularis* males), from *G. infernalis* Rivas and Schargel, 2008 by its smaller size in female (maximum 51.6 mm in *G. timidus* vs. minimum 55.6 mm in *G. infernalis*), the presence of markings on head and body in females (absence of dorsal pattern in *G. infernalis*), and in having the throat black with bluish white irregular stripes and blotches in females (immaculate in *G. infernalis*), from *G. humeralis* (Guichenot, 1855) by its larger size in females (minimum 44.1 mm SVL in *G. timidus* vs. maximum 40.5 mm SVL in *G. humeralis*), the presence of 3–4 lateral rows of scales at each side on distal part of fingers and toes (2 in *G. humeralis*), and the absence of a black antehumeral spot (always present in *G. humeralis*).

Although absent from the Guiana Shield region, *Gonatodes hasemani* Griffin, 1917 (a southwestern Amazonian species) was shown to be the sister species of *G. annularis* and to be part of the “Guiana Shield clade” *sensu* Schargel *et al.* (2010); *G. hasemani* is immediately distinguished from *G. timidus* in having a distinctly elongate supraciliary spine (absent in *G. timidus*), and in having the medial subcaudal scales not differentiated from adjacent scales on non-regenerated tail (distinctly differentiated in *G. timidus*).

Description of the Holotype. An adult male in very good condition (Figs. 1–4), with SVL of 46.9 mm. TL 52.5 mm, tail complete, but with distal part regenerated. Head 1.2 times longer than wide (HL: 11.4 mm; HW: 9.6 mm). Snout short (2.2 mm), 0.19 times HL, acutely rounded in dorsal view, rounded in profile, gently sloping towards top of head. Neck slightly narrower than head and body. Body nearly cylindrical, but wider than high; AXG 18.8 mm. Limbs well developed with moderately long digits, ToIV 6.5 mm, 0.74 times ShL (8.8 mm). Tail round in section, tapering towards tip, which is bluntly rounded.

Tongue relatively wide, narrowing anteriorly, covered by small scale-like papillae that become much less defined posteriorly; a bump bearing larger papillae is present in the middle of the tongue; posterior lateral margins indented; tip rounded with a short median cleft. Teeth small, subequal in length, conical.

Rostral large, visible from above, roughly heptagonal, with a small indentation on top margin from which a short cleft extends forward about halfway through rostral. Three postrostrals, lateral ones (supranasals) distinctly larger than median, which is partially contained in the indentation of the rostral scale, and slightly larger than adjacent posterior scales on snout. Rostrals and postrostrals with many minute tubercles. Nostril bordered by rostral, lateral postrostral, three postnasals, and first supralabial. Dorsal postnasal slightly larger than lower two on the left side, noticeably larger than lower two on the right side; dorsal postnasals noticeably larger than scales in the loreal region; lower two postnasals about same size as scales in the loreal region. Scales on top of snout roughly round and granular, juxtaposed, gradually becoming more oval-shaped and conical towards loreal region. Loreal scales number about 14 (both sides) in a straight line between postnasals and anterior margin of orbit. Scales decrease slightly in size from the posterostrals towards posterior part of the head. Scales on supraorbital region similar (in size and shape) to and continuous with those on top of head. Supraciliary flap without a distinctly elongate supraciliary spine, but three (both sides) larger conical supraciliary scales projecting posterolaterally. Pupil round. Supralabials 6 (both sides), first largest, last smallest, followed by 10/10 much smaller scales along the lip to rictus of mouth, all granular and similar in size to scales on temporal region. Fifth supralabial below centre of eye. Scales on temporal region similar (in size and shape) to those on posterior top of head, but scales contained in white stripes and blotches on head slightly larger and sometimes more spiny (especially on snout) than adjacent scales. Ear opening deep, very small (0.3 mm), much smaller than eye horizontal length (2.5 mm), obliquely oval.

Mental large with a round posterior margin. Postmentals three, distinctly larger than adjacent posterior scales. Scales on chin located directly behind postmentals small and polygonal, granular and tiny posteriorly, a few larger, polygonal, juxtaposed scales adjacent to infralabials. Infralabials 5 (right side)/4 (left side), decreasing in size posteriorly, first two very large and projecting onto ventral plane, suture between third and fourth below centre of eye.

Scales on nape and sides of neck continuous with those on head, granular, slightly conical anteriorly, becoming more conical posteriorly. Scales on throat smooth, imbricate, with round posterior margin, transition between juxtaposed granular, conical gular scales and scales on throat somewhat abrupt.



FIGURE 2. *Gonatodes timidus* sp. nov. Sexual dichromatism in life. Top left: Ventral face of male holotype (IRSNB 2664, 46.9 mm SVL). Lower left: Detail of the gular region in the same specimen. Top right: Ventral face of female paratype (IRSNB 2670, 51.6 mm SVL). Lower right: Detail of the gular region in the same specimen. Scale bars = 10 mm (top), and 5 mm (bottom).



FIGURE 3. *Gonatodes timidus* sp. nov. Details of lateral (top), dorsal (middle), and ventral (bottom) views of the head of the male holotype in life (IRSNB 2664, 46.9 mm SVL). Scale bar = 5 mm.

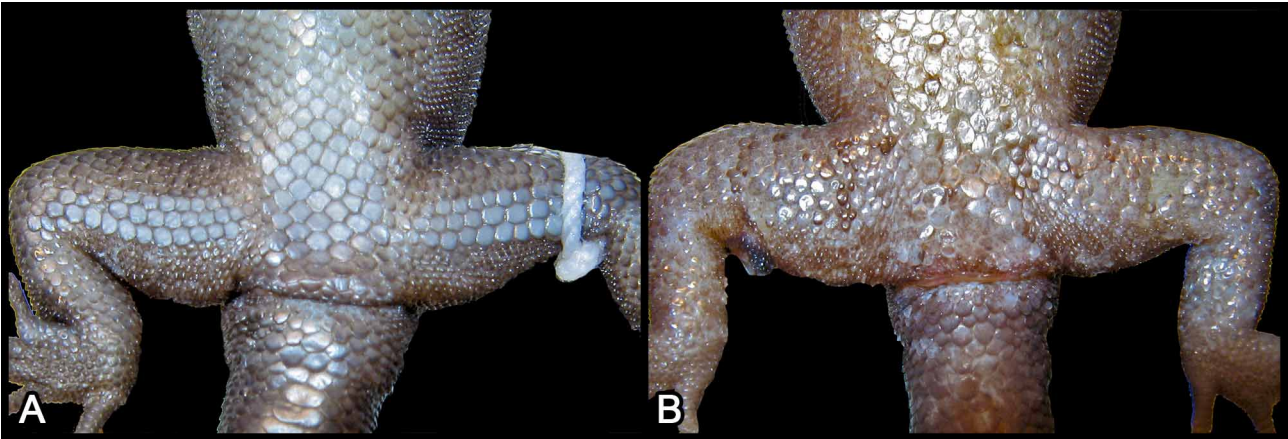


FIGURE 4. *Gonatodes timidus* sp. nov. Detail of pericloacal region in preserved specimens. A: Male holotype (IRSNB 2664), note distinct cluster (lower belly) and rows (thighs) of escutcheon scales. B: Female paratype (IRSNB 2670).

Dorsals subconical to conical, round to oval-shaped at base, slightly larger than scales on top of head, somewhat projecting posteriorly; dorsolaterally and on flanks slightly larger than dorsally, distinctly larger proximal to ventrolateral region. Transition between scales on flanks and ventrals somewhat abrupt, but not clearly demarcated.

Ventral region with scales distinctly larger than dorsals, slightly smaller on chest than on belly, smooth, with round to slightly acuminate posterior margin; ventrals in oblique rows also forming rather regular longitudinal rows on belly, with 46 scales along the midventral line between an imaginary line between the anterior part of the arm insertions with the body to the vent (not including small granules lining the edge of the cloaca). Scales around midbody about 94, of which about 15 are ventrals. Escutcheon scales evident: posterior belly (between thighs) composed of a cluster of about 45 scales distinctly different from other ventrals, larger, unpigmented except slightly on their lateral margins (under high magnification all ventrals are covered by tiny flecks of dark pigments, except scales on chest, which are also unpigmented). The same unpigmented scales are present under the thighs where they are arranged in three transverse rows of about 9–11 scales each (Fig. 4).

Scales on dorsum of tail slightly larger than on body, flat, smooth, imbricate, with posterior margin rather acuminate; transition area between the conical body scales and the caudal scales somewhat abrupt, but not clearly demarcated. Scales on underside of tail smooth, flat, imbricate, with round posterior margin, increasing in size towards midventral line; first six small subcaudals posterior to vent on midventral line increasing in size posteriorly, but not clearly differentiated from adjacent scales, followed by a midventral line of transversely enlarged scales clearly differentiated from adjacent scales, the pattern of these scales consisting in repetitive series of a single midventral scale in contact laterodistally with one scale per side followed by a single midventral in contact with two scales per side (1'1" sequence *sensu* Ávila-Pires 1995), although the first enlarged subcaudal is divided; scales on that midventral line entirely cover the underside of the distal portion of the tail (about 18.7 mm long, which corresponds to a regenerated part).

Scales on limbs conical and juxtaposed, except ventrally and on anterior surface of forearms and thighs where they are smooth, flat, with round to acuminate posterior margin. Lamellae under first (I) through fifth (V) finger (right/left side): **I**: 14/- (first finger missing on left side), **II**: 15/12 (claw, and possibly distal part of second finger missing on left side), **III**: 18/19, **IV**: 21/21, **V**: 17/17. Lamellae under first (I) through fifth (V) toe (right/left side): **I**: 11/12, **II**: 16/17, **III**: 20/20, **IV**: 22/23, **V**: 20/20. Fingers and toes with three to four lateral rows of scales distally. Claws exposed, non-retractile, between two basal scales (one dorsal and one ventral).

Colour of the Holotype in life. The dorsal surface of the head is black with bluish white irregular stripes and blotches, which are distributed as follows: one broken (left side) or incomplete (right side) stripe on each *canthus*, one small blotch located medially between the posterior corner of the eyes, one large oblique blotch located posterodorsally to eye on each side, and one small blotch above ear opening on each side; a very small yellowish white spot is present about 1 mm posterior to rictus on each side, three similar tiny spots are found on the side of the neck on each side, and another tiny yellowish white spot is found below the last infralabials on each side. The supralabials are iridescent black. Two bluish white broken, incomplete crescent-shaped collars are present on the neck

region, which is black dorsally and orange ventrolaterally. The underside of the head, including the infralabials and the chin, is orange with some scales partially or completely dark pigmented resulting in a faint reticulated pattern; the imbricate scales on the throat and the chest are orange, as well as most of the anterior surface of arms; all other ventral parts, including palms, soles, legs and tail are grey, except escutcheon scales, which are paler. A faint greyish brown, moderately broad vertebral stripe extends from posterior neck to near tail insertion. This stripe is irregularly margined by blackish blotches (five on the right side, three on the left side) and a few inconspicuous greenish brown to light brown suffusions. The flanks are chestnut brown with a few black flecks and small dark blotches. A darker patch is located on the right anterior flank, just posterior to arm insertion, and might correspond to a regenerated patch of skin. The limbs are similar in colour to the flanks, but with more dark markings. The tail is similar in colour to the dorsum, but slightly darker and without any longitudinal stripe. The iris is dark copper with a thin golden ring around the pupil. The claws are greyish white.

Colour of the Holotype in preservative. After one month in preservative, patterns are essentially the same as in life, but the orange colour became white and the bluish tint in the white blotches and stripes disappeared. The tongue is whitish, with its first one-third dark grey.

Variation in paratypes. The paratypes consist in two adult males (SVL 46.0 and 46.7 mm), four adult females (SVL from 44.1 to 51.6 mm), and three unsexed juveniles (SVL from 29.1 to 32.9 mm). Table 1 provides morphometric measurements of the type series, and Figs. 1–2 show variation and sexual dichromatism. Supralabial counts vary from 6 (n=7) to 7 (n=2, one side only), and infralabials counts vary from 4 (n=1, one side only) to 5 (n=8). Loreal scales counted in straight line between postnasals and anterior border of orbit range from 12 to 15, 14 being the most common state (n=5). Postrostrals range from 3 (n=7) to 4 (n=2). Postmentals range from 2 (n=7) to 3 (n=2). Scales around midbody range from 89 to 97, of which 16 to 19 are ventrals. There are 46 to 50 scales between an imaginary line between the anterior part of the arm insertions with the body to the vent. Clusters of escutcheon scales on lower belly range from about 45 to 50 scales; under the thighs these scales are arranged in three to four transverse rows of about 2 (most anterior row) to 13 scales each, these scales are absent in females (see Fig. 4). The pattern of subcaudals (*sensu* Ávila-Pires 1995) is consistent, with the first distinctly enlarged subcaudal divided only in the holotype and in one juvenile. Variation in the number of lamellae under first (I) through fifth (V) finger is as follows: **I:** 12–16, **II:** 16–19, **III:** 17–22, **IV:** 19–23, **V:** 16–20. Variation in the number of lamellae under first (I) through fifth (V) toe is as follows: **I:** 11–14, **II:** 16–18, **III:** 19–23, **IV:** 22–25, **V:** 19–23.

TABLE 1. Morphometric measurements (in mm) of the type series of *Gonatodes timidus* sp. nov. M = male, F = female, JUV = juvenile, other abbreviations are defined in the text.

Specimen number	Sex	SVL	TL	HL	HW	EN	AXG	ToIV	ShL
IRSNB 2664	M	46.9	52.5	11.4	9.6	3.6	18.8	6.5	8.8
IRSNB 2665	M	46.7	-	11.3	8.9	3.8	17.8	6.6	9.3
IRSNB 2666	M	46.0	-	11.1	8.7	3.5	18.9	5.9	9.2
IRSNB 2667	F	51.2	54.6	11.9	9.7	4.0	21.2	6.6	9.4
IRSNB 2668	F	44.1	-	10.6	8.2	3.1	19.0	5.8	8.6
IRSNB 2669	F	46.0	-	11.3	8.0	3.5	20.6	5.4	8.8
IRSNB 2670	F	51.6	46.6	12.0	10.0	4.2	23.1	6.8	9.7
IRSNB 2671	JUV	29.1	-	7.1	6.0	2.3	12.7	3.8	5.1
IRSNB 2672	JUV	32.9	-	8.6	6.4	2.5	13.7	4.7	6.5
IRSNB 2673	JUV	30.2	-	8.0	6.1	2.4	12.3	3.9	6.3

All paratypes have a few larger conical supraciliary scales projecting posterolaterally, but a distinct elongate supraciliary spine as in *Gonatodes alexandermendesii*, *G. astralis*, *G. hasemani* and *G. superciliaris* is always absent.

There is an evident sexual dichromatism (see Figs 1–2). In life, the two male paratypes are very similar to the holotype in colour and pattern, except that IRSNB 2665 has vivid yellow stripes and blotches on head (instead of bluish white), a less contrasted pattern on body, and a paler body colour. Stripes on *canthus* extend from postnasals to near the eye in both male paratypes (broken and incomplete in the holotype), and the two crescent-shaped collars

are more complete. Sides of neck are less orangish in the male paratypes than in the holotype. In preservative, the male paratypes are almost identical to the holotype, except in the shape of blotches and stripes on the head. IRSNB 2666 has a slightly pinkish throat (instead of white in the other paratype and in the holotype). In life, the female paratypes are brownish dorsally and laterally, with some whitish markings on tail, flanks, and limbs. Like in males a faint greyish brown, moderately broad vertebral stripe extends from posterior neck to near tail insertion and is irregularly margined by inconspicuous blackish blotches (more conspicuous in IRSNB 2668 and IRSNB 2669, which are the two smallest adult females). That vertebral stripe is also much more conspicuous in IRSNB 2668 and IRSNB 2669, and probably faints with age. The four female paratypes lack any colourful head ornamentation, but have two (only one in IRSNB 2670) thin, black-edged white crescent-shaped collars on the neck region, and usually a faint oblique stripe/blotch located posterodorsally to eye on each side (inconspicuous in IRSNB 2667). The dorsal surface of the head is slightly lighter than the body (distinctly lighter in IRSNB 2670). The supralabials are iridescent light grey, sometimes whitish posteriorly. The underside of the head, including the throat and the upper chest is black with bluish white reticulation (see Fig. 2). The infralabials are dark grey, usually with a variably large white area posteriorly. The ventral face is light grey with a suffusion of light orangish yellow (see Fig. 2); the ventral surface of the tail is dark grey. In preservative the female paratypes are dorsally darker than in life, but patterns remain essentially the same as in life. The bluish white colour became white, and the venter became very light grey. The three unsexed juveniles have essentially the same pattern and colouration as the adult females, including on throat, but patterns are more conspicuous and usually more contrasted. Two juveniles, IRSNB 2671 and IRSNB 2673, have a less contrasted throat pattern compared to the other juvenile. Females and juveniles usually have lighter iris.

Distribution and ecology. The new species is currently known only from the type locality, between 209–225 m elevation, in lowland primary rainforest at the base of the Iwokrama Mountains in the Iwokrama Forest Reserve, central Guyana (Fig. 5).

Gonatodes timidus is diurnal, locally abundant, but difficult to collect because specimens are very shy and tend to quickly escape in cracks and holes between boulders when disturbed. Most adult specimens have been collected on, or between relatively large boulders located about 10–30 m from a stream (Fig. 6). One adult female (IRSNB 2669) was collected between cavities on a tree trunk, close to large boulders. Two juveniles (IRSNB 2671–72) have been collected among the leaf litter close to boulders, an additional juvenile (IRSNB 2673) was collected in a rotten fallen tree trunk. No juveniles have been observed on rocks.

As reported in other *Gonatodes* species (see Cole & Kok 2006) individuals of *Gonatodes timidus* easily lose part of their skin as an antipredator strategy (regional intergumentary loss *sensu* Bauer *et al.* 1989), and also promptly self-amputate their tail (caudal autotomy), which makes exceedingly difficult to secure undamaged specimens.

The new species was found sympatric, but never syntopic, with *Gonatodes alexandermendesi*, which is here reported for the first time from the Iwokrama Forest Reserve.

Discussion

Gonatodes alexandermendesi and *G. timidus* although sympatric and occupying the same ecological niche (large boulders in primary rainforest) were not found syntopically. Apparently the new species is restricted to boulders located relatively close to rivers, whereas *G. alexandermendesi* has been found far from water, and at higher altitude. The single *G. alexandermendesi* specimen collected in Iwokrama was caught at about 850 m elevation, on the Iwokrama Mountains.

It is currently unknown if the colour variation in the head ornamentation (either bluish white or vivid yellow) in males of *G. timidus* is related to breeding condition, or if it is part of the intraspecific variation. Several males of both chromotypes were observed in March, and most females collected at that time were gravid, which seems to suggest intraspecific variation instead of breeding colour.

Although central Guyana has been reasonably surveyed over the last few years, the new species has never been reported from any other place than the type locality. It was not collected during intensive surveys in Kaieteur National Park (the author, unpubl. data), in the Mabura Hill Forest Reserve (R. Ernst, pers. comm.), nor in the Konawaruk river drainage (Cole & Kok 2006). This strongly suggests that the new species could be a highly restricted endemic to the Iwokrama Mountains area.

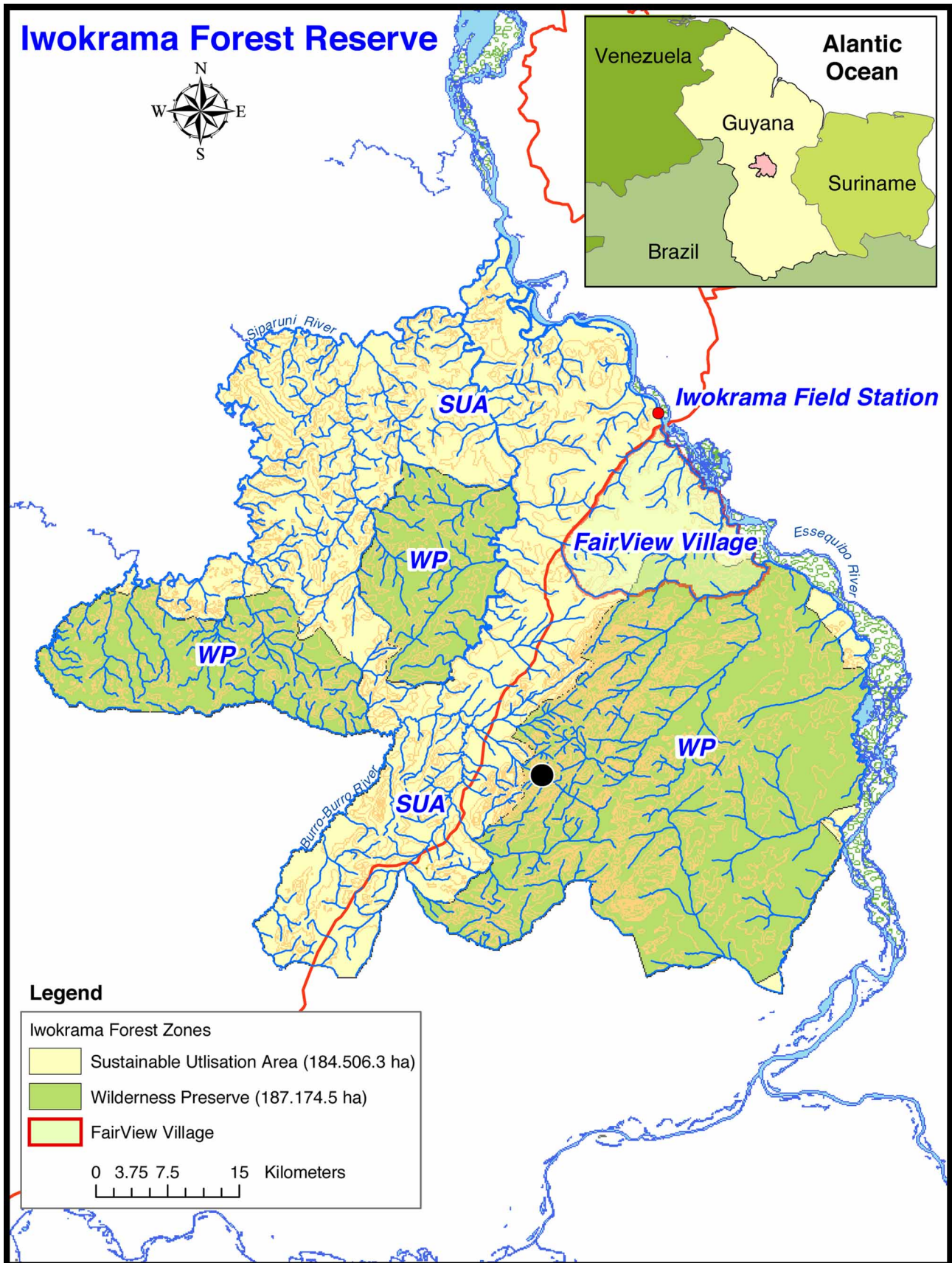


FIGURE 5. Map of the Iwokrama Forest Reserve. The black dot indicates the type locality of *Gonatodes timidus* sp. nov., at the foot of the Iwokrama Mountains. The red line crossing the Reserve is the road between Linden and Lethem. Map courtesy Iwokrama International Centre for Rainforest Conservation and Development.



FIGURE 6. Habitat of *Gonatodes timidus* **sp. nov.** at the type locality. A: Macrohabitat, the white arrow indicates a cluster of large boulders on the primary forest floor. B: Microhabitat, the white arrow indicates the exact place where the holotype of *G. timidus* **sp. nov.** was first spotted. It quickly escaped in the hole between the boulders indicated by a black arrow. C: The stream running at the type locality (22 March 2011).

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Literature cited

- Ávila-Pires, T.S.C. (1995) Lizards of Brazilian Amazonia (Reptilia: Squamata). *Zoologische Verhandelingen*, 299, 1–706.
- Barrio-Amorós, C.L. & Brewer-Carías, C. (2008) Herpetological results of the 2002 expedition to Sarisariñama, a tepui in Venezuelan Guayana, with the description of five new species. *Zootaxa*, 1942, 1–68.
- Bauer, A.M., Russell, A.P. & Shadwick, R.E. (1989) Mechanical properties and morphological correlates of fragile skin in gekkonid lizards. *The Journal of Experimental Biology*, 145, 79–102.
- Boulenger, G.A. (1887) On a new gekkoid lizard from British Guiana. *Proceedings of the Zoological Society of London*, 1887, 153–154.
- Cole, C.J. & Kok, P.J.R. (2006) A new species of gekkonid lizard (Sphaerodactylinae: *Gonatodes*) from Guyana, South America. *American Museum Novitates*, 3524, 1–13.
- Donnelly, M.A., Chen, M.H. & Watkins, G.G. (2005a) The Iwokrama herpetofauna: an exploration of diversity in a Guyanan rainforest. In: M.A. Donnelly, B.I. Crother, C. Guyer, M.H. Wake, and M.E. White (Eds), *Ecology and evolution in the tropics: a herpetological perspective*. University of Chicago Press, Chicago, pp. 428–460.
- Donnelly, M.A., Chen, M.H. & Watkins, G.G. (2005b) Sampling amphibians and reptiles in the Iwokrama Forest ecosystem. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 154, 55–69.
- Frost, D.R. (2011) *Amphibian Species of the World: an Online Reference*. Version 5.5 (31 January 2011). American Museum of Natural History, New York, USA. Available at: <http://research.amnh.org/herpetology/amphibia/index.php>. Access in: April 2011.
- Gamble, T., Bauer, A.M., Greenbaum, E. & Jackman, T.R. (2008) Evidence for Gondwanan vicariance in an ancient clade of gecko lizards. *Journal of Biogeography*, 35, 88–104.
- Griffin, L.E. (1917) A list of the South American lizards of the Carnegie Museum, with descriptions of four new species. *Annals of the Carnegie Museum*, 11, 304–320.
- Guichenot, A. (1855) Reptiles. In: Castelnau F. (Ed), *Animaux Nouveaux ou Rares Recueillis pendant l'Expédition dans les Parties Centrales de l'Amérique du Sud, de Rio de Janeiro à Lima, et de Lima au Pará; Exécutée par Ordre du Gouvernement Français pendant les Années 1843 à 1847, sous la Direction du Comte Francis de Castelnau. Reptiles*. Tome second. P. Bertrand, Paris, pp. 1–95.
- Lidth de Jeude, T.W. van (1887) On a collection of reptiles and fishes from the West Indies. *Notes Leyden Museum*, 9, 129–139.
- Rivas, G.A. & Schargel, W.E. (2008) Gecko on the rocks: an enigmatic new species of *Gonatodes* (Sphaerodactylidae) from Inselbergs of the Venezuelan Guayana. *Zootaxa*, 1925, 39–50.
- Rivero-Blanco, C. (1979) The Neotropical lizard genus *Gonatodes* Fitzinger (Sauria: Sphaerodactylinae). *PhD Dissertation*, Texas A&M University, College Station, Texas, 233 pp.
- Rojas-Runjaic, F.J.M., Infante-Rivero, E.E., Cabello, P. & Veloza, P. (2010) A new non-sexually dichromatic species of the genus *Gonatodes* (Sauria: Sphaerodactylidae) from Sierra de Perijá, Venezuela. *Zootaxa*, 2671, 1–16.
- Schargel, W.E., Rivas, G.A., Makowsky, R., Señaris, J.C., Natera, M.A., Barros, T.R., Molina, C.R. & Barrio-Amorós, C.L. (2010) Phylogenetic systematics of the genus *Gonatodes* (Squamata: Sphaerodactylidae) in the Guayana region, with description of a new species from Venezuela. *Systematics and Biodiversity*, 8, 321–339.
- Sturaro, M.J. & Ávila-Pires, T.S.C. (2011) Taxonomic revision of the geckos of the *Gonatodes concinnatus* complex (Squamata: Sphaerodactylidae), with description of two new species. *Zootaxa*, 2869, 1–36.
- Wake, M.H. & Donnelly, M.A. (2010) A new lungless caecilian (Amphibia: Gymnophiona) from Guyana. *Proceedings of the Royal Society of London B*, 227 (1683), 915–922.

APPENDIX: Additional material examined

- Gonatodes alexandermendesi*: **Guyana**, Potaro-Siparuni District, Kaieteur National Park, IRSNB 2630–36 (paratypes); Iwokrama Forest Reserve, IRSNB 18120.
- Gonatodes annularis*: **Brazil**, Amapá, Serra do Navio, RMNH 26391–92. Para, Cruz Alta, 6 km S Rio Trombetas, Município de Oriximiná, RMNH 26393. **French Guiana**, Matoury, Lac des Américains, Mont Grand Matoury, 30 m elevation, RMNH 26397. Rémire-Montjoly, Montagne du Mahury, 120 m elevation, RMNH 26394. Roura, Montagne Gabrielle, 50 m elevation, RMNH 26395–96. Saül, Montagne Belvédère, ca. 250 m elevation, IRSNB 14575. **Suriname**, Saramacca, Coppename River Basin, RMNH 4462 (holotype of the synonym, *Gonatodes boonii* Lidth de Jeude, 1904).
- Gonatodes humeralis*: **Guyana**, Potaro-Siparuni District, Kaieteur National Park, IRSNB 17243–44. Upper Takutu-Upper Essequibo District, South Rupununi Savanna, Dadanawa Ranch, IRSNB 16567–69.