

New records of the Large-eyed Green Snake, *Philothamnus macrops* (Boulenger 1895), from Mozambique

William R. Branch^{1,2,†}, Luke Verburg³, Julian Bayliss⁴, Christoph Kucharzewski⁵, Mark-Oliver Rödel⁵,
and Werner Conradie^{1,6,*}

Abstract. Northern Mozambique is one of the most poorly known regions in south-eastern Africa and only in the last decade has it received attention through a series of multi-collaborative biodiversity surveys. These surveys have revealed numerous new species but also species hitherto unrecorded from Mozambique. One of these is the Large-eyed Green snake, *Philothamnus macrops*, which was previously restricted to Tanzania and south-eastern coastal Kenya. We present seven new records of *P. macrops* from northern and central Mozambique, the first collected as early as 1997. Additional material and genetic analysis confirmed the material to be *P. macrops*, which extend the species' known range for more than 1000 km to the south. A historical overview of the species and its current known geographical distribution is also provided.

Keywords. Colubridae, montane, coastal, biodiversity

Introduction

Philothamnus macrops (Boulenger 1895) was described from the Usambara Mountains, Tanzania, and is therefore also known as the Usambara Green Snake (Spawls et al., 2018a). It was placed in the new genus *Oligolepis* by Boulenger (1895), based presumably on its low midbody scale rows (13). Sternfeld (1908) treated *Oligolepis* as a synonym of *Chlorophis*, which Loveridge (1951) in turn placed in the synonymy of

Philothamnus. With additional herpetological studies in Tanzania the known geographical distribution of *P. macrops* expanded and historical reviews of the East African snake fauna, Barbour and Loveridge (1928), Loveridge (1958), Broadley and Howell (1991) and Rasmussen (1981) consistently summarized the species' distribution as "coastal Tanzania and Zanzibar". Recently, the species has been recorded from the Shimba Hills in extreme southeast Kenya (Spawls et al., 2018b; Malonza et al., 2018). Loveridge (1958) recorded a specimen from Nchingidi (Lindi region) in extreme southeastern Tanzania, indicating that it may occur in adjacent Mozambique, but until now there have been no documented specimens from that country.

The herpetofauna of the northern half of Mozambique has never been formally reviewed, and has not been included in any African regional summaries, of East Africa (Spawls et al., 2018a) or Southern Africa (Branch, 1998). As a consequence, herpetological records for the region are scattered in diverse publications and are therefore easily overlooked. Broadley (1966) attempted to review the herpetofauna of south-east Africa, including the whole of Mozambique, but his thesis was never formally published and made no mention of *P. macrops* in Mozambique.

Since the cessation of hostilities in Mozambique in the last decade of the 20th century, the northern half of the

¹ Port Elizabeth Museum, P.O. Box 13147, Humewood 6013, South Africa.

² Department of Zoology, P.O. Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa.

³ Department of Zoology and Entomology, University of Pretoria, Pretoria, 0001, South Africa.

⁴ Department of Biological and Medical Sciences, Oxford Brookes University, Oxford, OX3 0BP, United Kingdom.

⁵ Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Invalidenstr. 43, 10115 Berlin, Germany.

⁶ School of Natural Resource Management, George Campus, Nelson Mandela University, George 6530, South Africa.

* Corresponding author. E-mail: werner@bayworld.co.za

† Deceased 14 October 2018

country has been increasingly explored, and numerous herpetological novelties continue to be discovered. Many are endemic species associated with vicariant speciation on the ‘sky island’ archipelago of ancient granitic inselbergs from Mount Chipirone in the south to Serra Mecula in the north (see references below). The first directed herpetological survey of the latter (Branch *et al.*, 2005a) resulted in the description of a new girdled lizard *Cordylus meculae* (Branch *et al.*, 2005b), and many other new country records for species shared with Tanzanian components of the Afromontane archipelago (*Melanoseps* cf. *ater*, *Scolecormorphus kirkii* and *Hyperolius substriatus*). Subsequent surveys of other ‘sky islands’ (Portik *et al.*, 2013a; Bayliss *et al.*, 2014; Conradie *et al.*, 2016) resulted in numerous additional herpetological discoveries, including a new Tree Viper (*Atheris mabuensis*: Branch and Bayliss, 2009), new chameleons of the genera *Nadzikambia*

(Branch and Tolley, 2010) and *Rhampholeon* (Branch *et al.*, 2014), a new dwarf gecko (*Lygodactylus regulus*: Portik *et al.*, 2013b) and four new species of Mongrel Frogs (*Nothophryne*: Conradie *et al.*, 2018a), as well as additional new records for the country (*Duberria shirana*: Conradie *et al.*, 2016). However, recent herpetofauna discoveries from the northern coastal region have not been restricted to ‘sky islands’ and include the fossorial reptiles *Zygaspis maraisi* (Broadley and Measey, 2016) and *Scolecoseps broadleyi* (Verburgt *et al.*, 2018), as well as the amphibian habitat specialist *Hyperolius stictus* (Conradie *et al.*, 2018a). Revitalisation of research at Gorongosa National Park in central Mozambique have seen the description of a new flat gecko (*Afroedura gorongosa*: Branch *et al.*, 2017).

During the above-mentioned surveys and further surveys, a number of unusual *Philothamnus* specimens were recorded. The first were collected in 1997 from Moebase in coastal Mozambique, almost 600 km south of other known records. No genetic material was available, and the taxonomic significance of unusual scalation features, paired preoculars, could not be assessed. The collection of additional unusual specimens even further south (Mount Mabu, PEM R21938 and 23971) finally permitted further investigations of their scalation, and also genetic relationships (Engelbrecht *et al.*, 2018). They confirmed that despite minor scalation differences all vouchers were identical with typical *P. macrops*. Below we provide full details of these specimens and discuss the diverse habitats in which they occur.

Material & Methods

We consulted primary literature (Boulenger, 1895; Barbour and Loveridge, 1928; Loveridge, 1958; Rasmussen, 1981; Hughes, 1985; Malonza *et al.*, 2018) to compile a historical overview of the species and produced a contemporary distribution map (Fig. 1). New Mozambique specimens examined are housed in the herpetological collection of Port Elizabeth Museum (PEM), South Africa and the Museum für Naturkunde Berlin (ZMB), Germany (Table 2).

Specimens were measured to the nearest 0.1 mm using digital calipers under a Nikon SMZ1270 dissecting microscope. The following measurements were recorded: Snout–Vent Length (SVL)—tip of the snout to the anterior edge of the cloacal scale; Tail Length (Tail)—tip of tail to posterior edge of the cloaca scale; Total Length (TL) combined SVL and Tail Length; Head Length (HL)—from just behind the angle of the jaw to the tip of the snout; Head Width

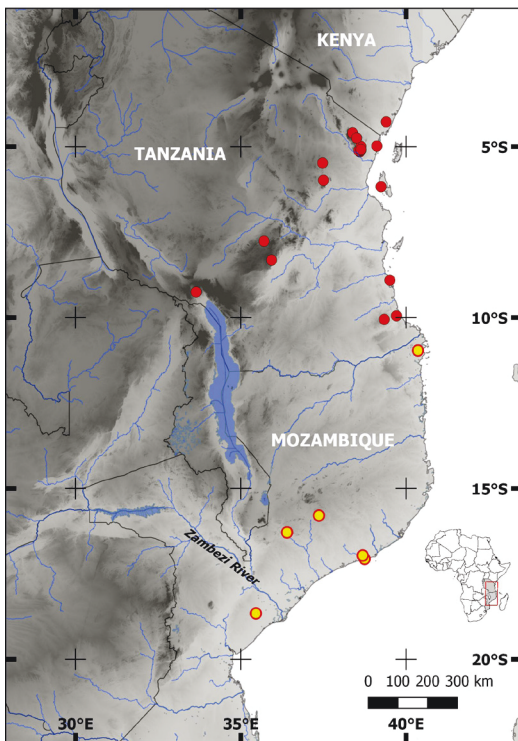


Figure 1. Recorded localities of *Philothamnus macrops* in eastern Africa. New Mozambique records are indicated by the yellow circles. Gray background represents altitude (dark = high, light = low). Main river systems are represented by light blue lines.

(HW)—maximum width of head (usually at mid-eye); Snout Eye (SE)—from tip of snout to anterior margin of orbit; Orbit Diameter (OD) maximum horizontal width of orbit.

Ventral and subcaudal scales counts were counted using Dowling’s method (Dowling, 1951). Scale rows were recorded anteriorly (ASR, one head length behind the neck), at midbody (MSR), and posteriorly (PSR, one head length anterior to the cloaca). Supra- and infralabials were counted for both sides, and the labials entering the orbit or in contact with the anterior chin shields were recorded, respectively. Details of other head shield conditions followed standard descriptions (see drawings in Spawls et al. (2018a)).

Results

Systematic accounts.—When describing *Oligolepis macrops*, Boulenger (1895) gave a terse description for his new species, for which the main features are summarized in Table 1. Barbour and Loveridge (1928) expanded on this description by examining an additional 22 topotypic specimens and confirmed this species to be valid, but that Boulenger’s specimen was based on an aberrant individual. They concluded

that the most important diagnostic feature for this species were 13 midbody scale rows (15 in most other *Philothamnus* species), but overlooked *Philothamnus carinatus* (Andersson 1901), which also features 13 midbody scale rows (but has an undivided anal scale). Subsequent years have seen the description of *Philothamnus hughesi* Trape and Roux-Estève 1990 which also features 13 midbody scale rows. Barbour and Loveridge (1928) drew attention to the moderate keeling which was not discussed for the type specimen. Loveridge (1958) refined the description of Barbour and Loveridge (1928) by removing *P. battersbyi* material used by them in error.

Hughes (1985), after summarizing data for 33 individuals from Tanzania (many examined by the above authors) from Tanzania, noted that *P. macrops* was easily distinguished by having only 13 midbody scale rows, a low number of weakly keeled ventrals (135–146), and a low supralabial count of 8 with only two labials entering the orbit (4th and 5th). Other scalation features noted were: anal divided; subcaudals 83–96 in males and 73–88 in females; and temporals 1+1. Boulenger (1895) noted that the juvenile type was “olive above, with rather irregular light crossbars;

Table 1. Summary of measurements (mm) and pholidosis data for published *Philothamnus macrops* records. See Material and Methods for explanation of abbreviations used (na = not available or reported).

	Type (BMNH 946.1.10.32) Juvenile	Barbour and Loveridge (1928) N = 22	Loveridge (1958) N = not recorded	Rasmussen (1981) N = 3	Hughes (1985) N = 33
SVL + Tail = TL	215 + 57 = 272 (juvenile)	560 + 250 = 810 (largest male) 655 + 260 = 915 (largest female)	560 + 250 = 810 (largest male) 690 + 260 = 950 (largest female)	520 (male) 250, 330 (females)	na
Ventrals	148	136–169	135–146 (males) 135–148 (female)	135 (male) 138, 143 (females)	135–143 (males) 136–146 (females)
Subcaudals	75	85–122 (males) 82–87 (females)	84–97 (males) 74–88 (females)	69 (male) 78, 80 (females)	83–96 (males) 73–88 (females)
MSR	13	13	13 (rarely 11)	13	13
Anal (Entire / Divided)	divided	na	divided	2 divided 1 entire	divided
Supralabials (number touching orbit)	9 (5,6)	mostly 8 (4,5) with only two 9 (5,6)	8 (occasionally 9) (4,5 & 5,6)	8(4,5), 9(5,6)	8(4,5)
Infralabials (number touching anterior sublingual)	na (1–5)	na	8–12 (1–6)	10 (1–5), 11(1–5)	na
Preoculars	1	na	1 (rarely 2)	1	na
Postoculars	2	na	2	2	na
Temporals	1+2	na	1+1, 1+2	1+1, 1+2	1+1

Table 2. Measurements (mm) and pholidosis for *Philothamnus macrops* from northern Mozambique. See Material and Methods for explanation of abbreviations. * includes terminal spine, ** (right, left), t = truncated.

	PEM R13177	PEM R13178	PEM R23971	PEM R21938	PEM R21963	PEM R23950	ZMB 88426
Sex	Female	Female	Female	Female	Unknown	Female	Male
Locality	Moebase	Namugure Village	Mount Mabu	Mount Mabu	25km SW Palma	Mount Lico	Coutada 12
SVL + Tail = TL	428 + 168 = 596	413 + 153 = 566	500 + 176 = 676	532 + 188 = 620	442 + 152 = 594	523 + 198 = 721	458 + 202 = 660
Head Width	9.4	9.5	10.1	8.9	-	10.2	7.5
Head Length	19.0	18.5	20.0	16.8	-	21.2	18.9
Orbit Diameter (OD)	4.2	4.6	4.0	4.8	-	4.8	4.9
Snout-Eye (SE)	6.3	5.9	6.4	6.2	-	7.3	6.0
SE/OD	1.5	1.3	1.6	1.3		1.5	1.3
Ventrals	141	141	143	148	142	148	135
Subcaudals *	79	78	74	83	64 (t)	80	84
ASR	13	13	13	15	13	13	13
MSR	13	13	13	13	13	13	13
PSR	11	11	11	11	11	11	11
Anal (Entire / Divided)	divided	divided	divided	divided	divided	divided	divided
Supralabials (number touching orbit)	8 (4,5)	8 (4,5)	8 (4,5)	8	8 (4,5)	8 (4,5)	8 (4,5)
Infralabials (number touching anterior sublingual)	9 (1-5)	9 (1-5)	9 (1-5)	9 (1-5)	9 (1-5)	10 (1-5)	10 (1-5)
Preoculars	2	1	1	1	2	2	1
Postoculars	2	2	2	2	2	2	2

upper lip and lower parts white." However, subsequent Tanzanian specimens have revealed much greater colour variation, with specimens ranging from uniform green to reddish or even pale yellow in ground colour, with a varying overlay of fine, sometimes broken, pale cross bars, or even black blotches that may form irregular bands (see Spawls *et al.*, 2018a for more detail and illustrations).

Description of new Mozambican material.—New Mozambican material that was collected from 1997–2018 is discussed below, while scalation and measurements are summarised in Table 2.

1. *Philothamnus macrops* (PEM R13177), vicinity of base camp, Moebase village (-17.05000°S, 38.73333°E, 8 m a.s.l.), Zambezia Province, Mozambique, collected by WRB from specimens brought in by local villagers, 13 May 1997.

Description (Fig. 2C, 3A and B): An adult female; tail 2.6 times body length; head width at mid eye level: 7.8 mm, 9.4 mm at widest point of temporal region; distance between anterior border of eye and posterior margin of nostril: 3.5 mm; rostral: wider than high (3.5 mm vs. 1.7 mm), visible from above; nasal: divided, nostril large in central position; loreal: 1, longer than

high (2.5 mm vs. 1.3 mm); preocular widely separated from the frontal; upper postoculars touches parietal and anterior temporal, lower one touches the anterior temporal and 5th–7th supralabials; temporals large and nearly rectangular, 1st longer than wide touching parietal and supralabials 6 and 7, 2nd pair upper temporal scale smaller than lower one, which is in contact with supralabial 7 and 8; inframaxillars: 2 pairs, nearly same width, the posterior pair longer and only on the anterior half in contact; dorsal scales: smooth, those bordering the ventral largest and lacking apical pits, scales along the back with 2 (sometimes 1) apical pits; scale row reduction occurs by fusion of scale 3 and 4 on both sides at ventral scales 77/78 (right/left), dorsocaudal scale row reduction occurs by fusion of scale 2 and 3 on both sides at subcaudal 10/10 and scale 1 and 2 on both sides at subcaudal 57/57; ventral scales: weak laterally keeled not extending onto subcaudals, subcaudals paired; nasal suture: 2.3 mm; prefrontal suture: 1.2 mm; distance between anterior edge of frontal to the posterior edge of the rostral: 3.5 mm; frontal: length = 5.1 mm, width = 2.1 mm; parietal suture: 4.0 mm; pupil round; maxillary teeth: ungrooved and the posterior ones distinctly enlarged. Colouration of iris is yellow-orange; head uniform olive to red-brown, paler on labials and without

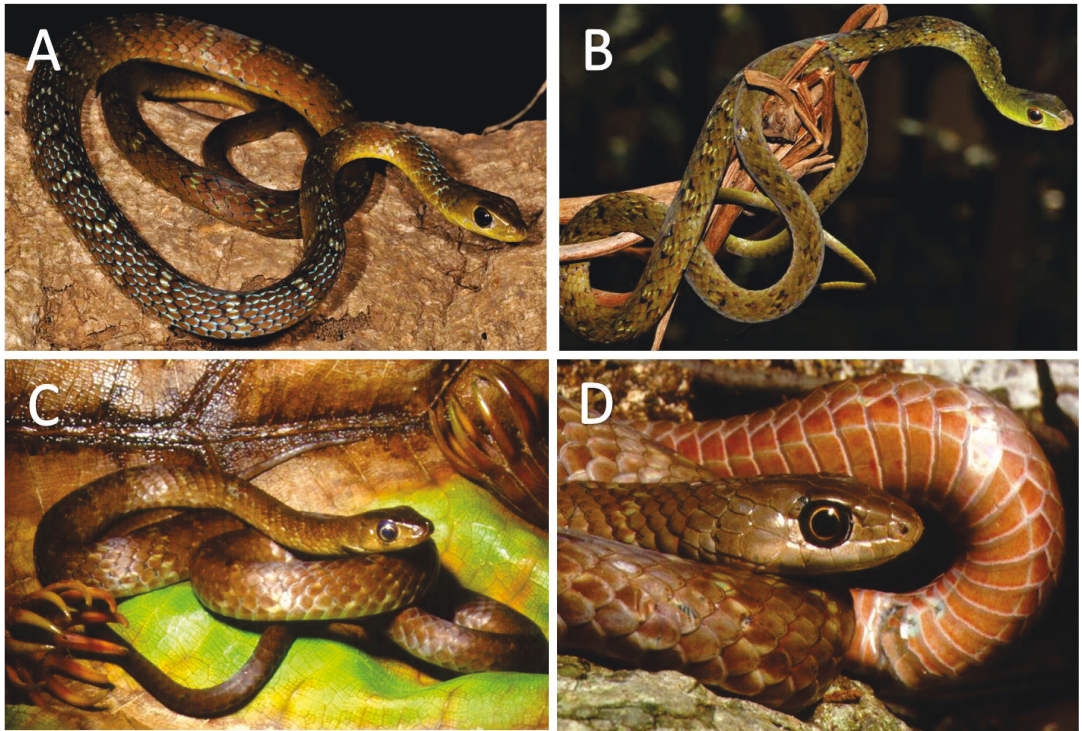


Figure 2. Various *Philothamnus macrops* illustrating colour variation. A: reddish adult from South Nguru Mountains, Mvomero District, Morogoro Region, Tanzania; B: greenish adult from coastal Tanzania (exact locality unknown); C: Moebase camp (PEM R13177), Zambezia Province, Mozambique; D: south of Namugure village (R13178), Zambezia Province, Mozambique. Note: well-keeled ventrals, two preoculars and reddish colouration, particularly the uniform ventrum in PEM R13177; and the reddish dorsal colour with faint, single scale wide pale bands on forebody.

markings on the crown; body medium red-brown with 38 irregular, pale tan bands on the dorsum, that are often broken into staggered pairs; the bands are one scale wide, but cross scale margins (half of one scale, and half of adjacent scale), and are bordered posteriorly, and also sometimes anteriorly, with a purple brown margin; tail uniform darkish red-brown dorsally; gulars pale cream, infused on throat with rust-red that concentrates on the base of the scale and lateral margins; ventrum rust-red and uniform across whole belly, except for a thin pale proximal edge to each ventral scale and on the keel, becoming more intense from midbody proximally, until ventral surface of tail is uniform bright red-brown.

Habitat: The specimen was collected from a habitat mosaic of coastal dune forest, palm savannah and sedge meadows.

Natural History: At Moebase, local villagers gave the local name as Hiriri (but this was used for other small

species such as house snakes as well). It was reported to live under bark and eats lizards (*Hemidactylus* sp.).

2. *Philothamnus macrops* (PEM R13178), vicinity of Namugure village (-16.95000°S, 38.68333°E, 30 m asl), Zambezia Province, Mozambique, collected by WRB from specimens brought in by local villagers, 14 May 1997.

Description (Fig. 2D): An adult female; tail 2.7 times body length; head width at mid eye level: 8.2 mm, 9.5 mm at widest point of temporal region; distance between anterior border of eye and posterior margin of nostril: 3.6 mm; rostral: wider than high (3.3 mm vs. 1.4 mm), visible from above; nasal: divided, nostril large in central position; loreal: 1, longer than high (2.3 mm vs. 0.9 mm); preocular widely separated from the frontal; upper postoculars touches parietal and anterior temporal, lower one touches the anterior temporal and 5th–6th

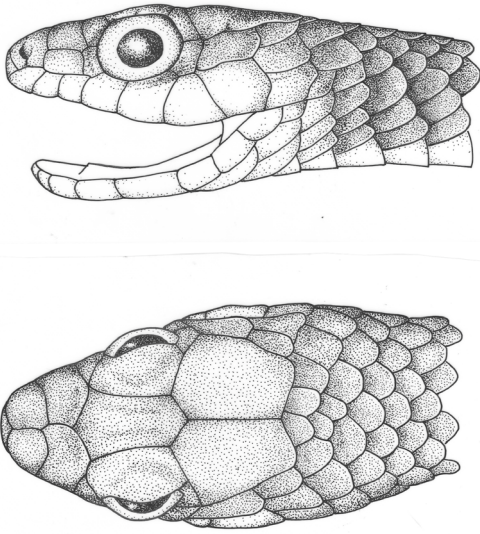


Figure 3. Lateral and dorsal portrait drawing of *Philothamnus macrops* (PEM R13177, Moebase camp, Zambezia Province, Mozambique) showing the relatively large eye and two preoculars, a common feature of Mozambique material.

supralabials; temporals large and nearly rectangular, 1st longer than wide touching parietal and supralabials 6 and 7, 2nd pair upper temporal scale smaller than lower one, which is touching supralabial 7 and 8; inframaxillars: 2 pairs, nearly same width, the posterior pair longer and only on the anterior half in contact; dorsal scales: smooth, those bordering the ventral largest and lacking apical pits, scales along the back with 2 (sometimes 1) apical pits; scale row reduction occurs by fusion of scale 3 and 4 on both sides at ventrals 79/78 (right/left), dorsocaudal scale row reduction occurs by fusion of scale 2 and 3 on both sides at subcaudals 11/8 and scale 1 and 2 on both sides at subcaudals 57/55; ventral scales: weak laterally keeled not extending onto subcaudals, subcaudals divided, an obvious umbilical scar visible between ventrals 129–132; nasal suture: 2.4 mm; prefrontal suture: 1.4 mm; distance between anterior edge of frontal to the posterior edge of the rostral: 3.6 mm; frontal: length = 5.3 mm, width = 2.5 mm; parietal suture: 4.5 mm; pupil round; maxillary teeth: ungrooved and the posterior ones distinctly enlarged. Colouration of iris is golden; crown of head brown, lighter on sides and on lips, cream below with yellow infusion on throat; dorsum brown with 37 vague, pale dorsal blotches, less than one scale wide that may be staggered or paired,

and may extend onto the flanks as single or paired pale patches on the enlarged dorsal scales bordering the ventrals; upper surface of tail uniform purple-brown; venter pinkish with paler trailing edge to ventrals, becoming dark towards vent and particularly beneath the tail.

Habitat: The specimen was collected from a habitat mosaic of coastal dune forest, palm savannah and sedge meadows.

3. *Philothamnus macrops* (PEM R23971) vicinity of Mount Mabu forest base camp (-16.28333°S, 36.40000°E, 950 m a.s.l.), Zambezia Province, Mozambique, J. Bayliss, 27 October 2008.

Description (Fig. 4A): An adult female, with head damaged just behind the parietal scales; tail 2.8 times body length; head width at mid eye level: 8.0 mm; distance between anterior border of eye and posterior margin of nostril: 3.8 mm; rostral: wider than high (3.9 mm vs. 2.1 mm), visible from above; nasal: divided, nostril large in central position; loreal: 1, longer than high (2.3 mm vs. 1.4 mm); preocular widely separated from the frontal; upper postoculars touches parietal and anterior temporal, lower one touches the anterior temporal and 5th–6th supralabials; temporals large and nearly rectangular, 1st as long as wide touching parietal and supralabials 6 and 7, 2nd pair upper temporal scale smaller than lower, which touch supralabial 7 and 8; inframaxillars: 2 pairs, nearly same width, the posterior pair longer and only on the anterior half in contact; dorsal scales: smooth, those bordering the ventral largest and lacking apical pits, scales along the back with 2 (sometimes 1) apical pits; scale row reduction occurs by fusion of scale 3 and 4 on both sides at ventrals 66/62 (right/left), dorsocaudal scale row reduction occurs by fusion of scale 2 and 3 on both sides at subcaudals 9/7 and scale 1 and 2 on both sides at subcaudals 47/48; ventral scales: very weak laterally keeled not extending onto subcaudals, subcaudals divided; nasal suture: 2.1 mm; prefrontal suture: 1.6 mm; distance between anterior edge of frontal to the posterior edge of the rostral: 3.7 mm; frontal: length = 5.8 mm, width = 2.5 mm; parietal suture: 4.2 mm; pupil round; maxillary teeth: ungrooved and the posterior ones distinctly enlarged. Colouration (based on a preserved specimen, life colouration is unknown) dorsally taupe colouration with numerous irregular darker almost black blotches, bordered by turquoise bars; cream coloured ventral anterior progressively getting darker towards the cloaca; interstitial skin black; posterior ventral third of

tail almost black, dorsally irregular dark blotches that fuse posteriorly to tip of tail to form a black tail, anterior lateral half of tail taupe in colouration, with irregular black blotches joining posteriorly to form a dark brown posterior half of the tail.

Habitat: Found on the forest floor in closed canopy evergreen forest.

4. *Philothamnus macrops* (PEM R21938), collected in ridge forest halfway between forest camp and summit on Mount Mabú (-16.28333°S, 36.38333°E, 1200 m a.s.l.), Zambezia Province, Mozambique, J. Bayliss, 12–16 October 2012.

Description (Fig. 4B): An adult female; tail 3.1 times body length head width at mid eye level: 6.2 mm, 9.1 mm at widest point of temporal region; distance between anterior border of eye and posterior margin of nostril: 3.2 mm; rostral: wider than high (3.1 mm vs. 1.9 mm), visible from above; nasal: divided, nostril large in central position; loreal: 1, longer than high (2.4 mm vs. 1.4 mm; left side as right side is damaged); preocular narrowly touching the frontal; upper postoculars touches parietal and anterior temporal, lower one touches the anterior temporal and 5th–7th supralabials; temporals large and nearly rectangular; inframaxillars: 2 pairs, nearly same width, the posterior pair longer and only on the anterior half in contact; dorsal scales: smooth, those bordering the ventral largest with no visible apical pits; scale row reduction from occurs by fusion of scale 2 and 3 on both sides at ventrals 76/73 (right/left) and by fusion of scale

2 and 3 on both sides at ventrals 83/83, dorsocaudal scale row reduction occurs by fusion of scale 2 and 3 on both sides at subcaudals 12/15 and scale 1 and 2 on both sides at subcaudals 64/64; ventral scales: weak laterally keeled, not extending onto subcaudals, subcaudals divided; nasal suture: 2.7 mm; prefrontal suture: 1.9 mm; distance between anterior edge of frontal to the posterior edge of the rostral: 4.2 mm; frontal: length = 5.7 mm, width = 3.0 mm; parietal suture: 4.9 mm; pupil round; maxillary teeth: ungrooved and the posterior ones distinctly enlarged. Colouration: dorsally and ventrally very dark almost black with a few randomly scattered turquoise coloured scales.

Habitat: Found on the forest floor in closed canopy evergreen forest.

5. *Philothamnus macrops* (PEM R21963), approx. 25 km SW of Palma (main road to Mocimboa da Praia) (-10.96667°S, 40.35000°E, 93 m a.s.l.), Cabo Delgado, Mozambique, L. Verburgt, 1 February 2014.

Note: This individual is a road kill with limited morphological features for a proper description. Description: Sex unknown; tail 2.9 body length; ventrals very weakly laterally keeled not extending onto the subcaudals. Colouration of this individual seems congruent with the two coastal individuals discussed above (PEM R13177 and R13178).

Habitat: A mosaic of heavily disturbed habitat (near a village) and patchy but dense *Berlinia orientalis* woodland.

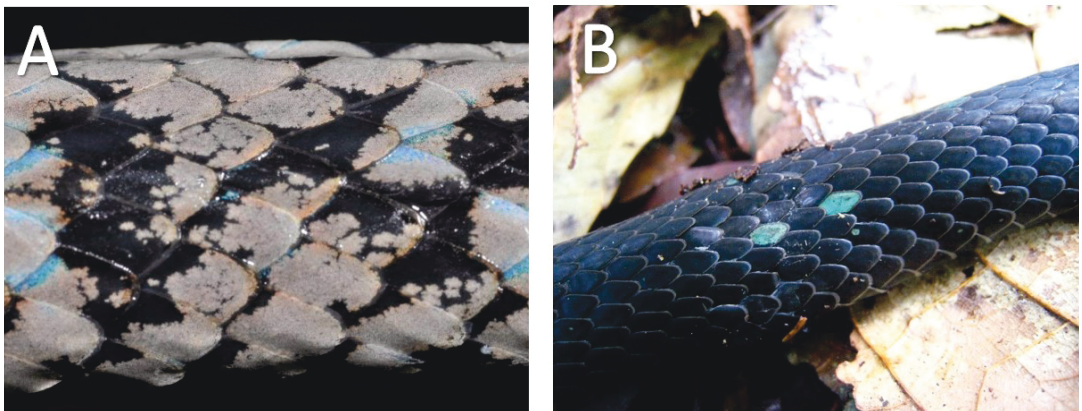


Figure 4. Unusual coloration of Mount Mabú *Philothamnus macrops*. A: PEM R23971, midbody dorsal coloration of alcohol-preserved specimen with irregular dark blotches. A: PEM R21938, midbody dorsal coloration of live animal.

6. *Philothamnus macrops* (PEM R23950), Top forest camp Mount Lico (-15.78333°S, 37.35000°E, 905 m a.s.l.), Zambezia Province, Mozambique, J. Bayliss, 27 October 2018.

Description (Fig. 5A–D): An adult female; tail 2.6 times body length; head width at mid eye level: 8.4 mm 10.5 mm at widest point of temporal region; distance between anterior border of eye and posterior margin of nostril: 4.4 mm; rostral: wider than high (4.3 mm vs. 2.2 mm), visible from above; nasal: divided, nostril large in central position; loreal: 1, longer than high (2.3 mm vs. 1.3 mm); preocular narrowly separated from the frontal; upper postoculars touches parietal and anterior temporal, lower one touches the anterior temporal and 5th–6th supralabials; temporals large and nearly rectangular, 1st as long as wide touching parietal and supralabials 6 and 7, 2nd pair upper temporal scale smaller than lower, which touch supralabial 7 and 8; inframaxillars: 2 pairs, nearly same width, the posterior pair longer and only on

the anterior half in contact; dorsal scales: smooth, those bordering the ventral largest and lacking apical pits, scales along the back with 2 (sometimes 1) apical pits; scale row reduction occurs by fusion of scale 3 and 4 on both sides at ventrals 83/83 (right/left), dorsocaudal scale row reduction occurs by fusion of scale 2 and 3 on both sides at subcaudals 15/16 and scale 1 and 2 on both sides at subcaudals 67/66; ventral scales: weak lateral keels not extending onto subcaudals; nasal suture: 2.4 mm; prefrontal suture: 1.4 mm; distance between anterior edge of frontal to the posterior edge of the rostral: 4.1 mm; frontal: length = 5.9 mm, width = 3.4 mm; parietal suture: 5.3 mm; pupil round; maxillary teeth: ungrooved and the posterior ones distinctly enlarged. Colouration of iris is golden; head uniform olive brown and without markings on the crown, paler on labials, dorsally olive brown with 31 irregular lighter green bands 2–5 scales wide and dark edged anteriorly, not extending onto tail; tail uniform brown dorsally;

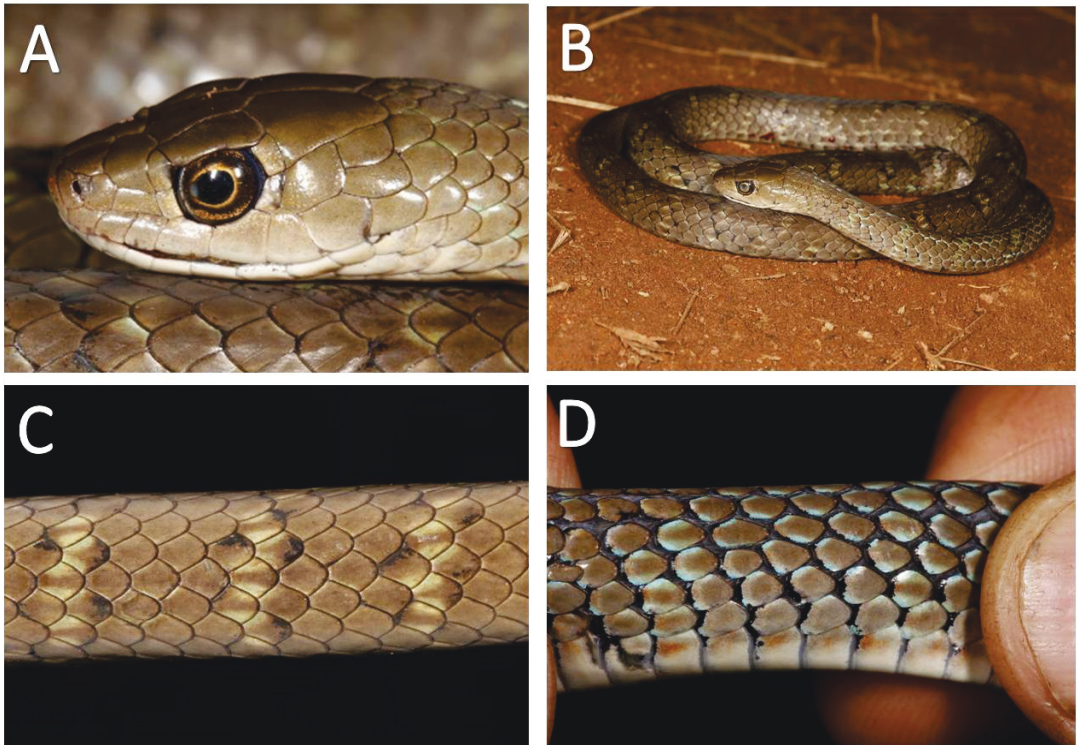


Figure 5. *Philothamnus macrops* (PEM R23950) from Mount Lico, Zambezia Province, Mozambique. A: lateral view of head, clearly showing the two pre- and postoculars; B: dorsolateral view; C: midbody dorsal colouration showing irregular dark blotches; D: lateral view of neck region showing the black inner scale colouration and blue flecks.

interstitial skin black; gulars pale cream; ventrally pale cream anteriorly, progressively becoming lighter brown posteriorly, with lateral edges of ventral scales with orange markings.

Habitat: Found active on the forest floor in closed canopy forest near a stream, eating a frog (*Arthroleptis cf. francei*).

7. *Philothamnus macrops* (ZMB 88426), Nyago Camp, Coutada 12 (-18.66033°S, 35.45592°E, 74 m a.s.l.), Sofala Province, Mozambique, J.A. Guyton & P. Naskrecki, 16 April 2015.

Description: An adult male; tail 2.2 times in body length; head width at mid eye level: 7.5 mm, 12.0 mm at widest point of temporal region; distance between anterior border of eye and posterior margin of nostril: 4.0 mm; on both sides a small additional scale touching the mouth between 9th and 10th infralabial; rostral: wider than high (4.0 mm vs. 1.9 mm), visible from above; nasal: divided, nostril large in central position; loreal: 1, longer than high (2.5 mm vs. 1.1 mm); preocular widely separated from the frontal; upper postoculars touches parietal and anterior temporal, lower one touches the anterior temporal and 5th–7th supralabials; temporals large and nearly rectangular; inframaxillars: 2 pairs, nearly same width, the posterior pair longer and only on the anterior half in contact; dorsal scales: smooth with 2 apical pits; scale row reduction occurs by fusion of scale 3 and 4 on both sides at ventrals 77/77 (right/left), dorsocaudal scale row reduction occurs by fusion of scale 2 and 3 on both sides at subcaudals 18/17 and scale 1 and 2 on both sides at subcaudals 56/54; ventral scales: weak laterally keeled, not extending onto subcaudals, subcaudals divided; nasal suture: 2.3 mm; prefrontal suture: 1.7 mm; distance between anterior edge of frontal to the posterior edge of the rostral: 4.2 mm; frontal: length = 5.9 mm, width = 4.0 mm; parietal suture: 5.3 mm; pupil round; maxillary teeth: ungrooved and the posterior ones distinctly enlarged. Colouration: dorsal color grey-brown with ca. 32 pale half bands with dark brown margins. Most of the bands are arranged alternating without touching each other vertebally.

Habitat: The injured specimen was collected during the day when it entered the camp in open to closed woodland on sandy soil.

Discussion

Philothamnus macrops can be easily distinguished from other known congeners in East Africa by the midbody scale row count of 13 (all species except *P.*

carinatus and *P. hughesi*), from which it differs in usually having a divided anal scale (undivided in *P. carinatus*) and keeled ventrals (smooth in *P. hughesi*). The standard scalation of *P. macrops* includes: ventrals 135–146 (males)/135–148 (female); subcaudals 83–97 (males)/73–88 (females), 13 midbody scale rows (rarely 11), mostly 8 upper labials with the 4th and 5th entering the orbit, 8–12 lower labials with the first 6 touching the anterior sublingual, 1 (rarely 2) preoculars, 2 postoculars, and 1+1 or 1+2 temporal scale arrangement. The ventrals are weakly keeled to some degree, while the subcaudals are unkeeled. The largest recorded male measured 560 + 250 = 810 mm and female measured 690 + 260 = 950 mm. The new Mozambique material is congruent with the above overall scalation but differs in that 50% of the individuals had 2 preoculars compared to the average 1 preocular and one individual had smooth ventrals. Despite these minor scalation differences and large geographic range extension, the Mount Mabu genetic material was not significantly divergent from typical *P. macrops* from Tanzania (4.3% for *cyt b*: Engelbrecht et al., 2018).

The new records for Mozambique extend the known distribution of this species ~1000 km south of the known Lindi record in southern Tanzania, including one record (ZMB 88426; Coutada 12), from south of the Zambezi River. Historically, this species has been documented to occur in “Coastal Tanzania and Zanzibar”, but the new material from Mozambique indicates that this species occurs over a much wider range from sea level to inland forested montane inselbergs (~1200 m a.s.l.). It is quite likely that this species occurs on many more of the forested montane inselbergs in central and northern Mozambique. The addition of *P. macrops* to the herpetofauna of Mozambique highlights the importance of rapid biodiversity studies to fully understand and document Mozambique’s biodiversity. In addition, the industrialization of portions of the northern coastal regions in Mozambique and the necessary environmental impact studies accompanying such developments could provide further insight into the biodiversity of these poorly sampled regions, as recently demonstrated by the discovery of two new species to science (*Hyperolius stictus*: Conradie et al., 2018b; *Scolecoseps broadleyi*: Verburg et al., 2018).

The current knowledge of the geographical distribution of *P. macrops* revealed that its common name is confusing as it is no longer restricted to the Usambara Mountains. For this reason we suggest to use the more descriptive name Large-eyed Green Snake.

Acknowledgements. We dedicate this paper to William R. Branch who sadly passed away while this paper was in review. He was a mentor and good friend to all co-authors and will be sorely missed. Material was collected on collaborative expeditions funded by Coastal Environmental Services (Moebase material), KEW/Darwin Initiative and FFI Mabu Forest Conservation Project (Mount Mabu specimens), Enviro-Insight (Palma specimen), Greg Carr, the Gorongosa Restoration Project, and the Prager Family (specimen from Coutada 12), and privately funded by JB (Mount Lico specimen). MOR thanks Jennifer A. Guyton and Piotr Naskrecki for collecting the Coutada 12 snake, Marc Stalmans and Pedro Muagura for research and collecting permits (all Gorongosa Restoration Project), and Lucilia Chuquela (Natural History Museum, Maputo) for specimen export permits. Additional fieldwork assistance was provided by Gabriella Bittencourt and Ursula Verburgt. Genetic confirmation of Mount Mabu and Palma individuals was performed by Hanlie Engelbrecht (South African National Biodiversity Institute). The excellent line drawing for the Moebase snake was prepared by Jo Keogh.

References

- Bayliss, J., Timberlake, J., Branch, W.R., Bruessow, C., Collins, S., Congdon, C., et al. (2014): The discovery, biodiversity and conservation of Mabu forest—the largest mid-elevation rainforest in southern Africa. *Oryx* **48**: 177–185.
- Barbour, T., Loveridge, A. (1928): A comparative study of the herpetological fauna of the Uluguru and Usambara mountains, Tanzania Territory with descriptions of new species. *Memoirs of the Museum of Comparative Zoology, Cambridge (Massachusetts)* **50**: 85–265.
- Boulenger, G.A. (1895): Descriptions of two new snakes from Usambara, German East Africa. *Annals and Magazine of Natural History* **16**: 171–173.
- Branch, W.R. (1998): *Field Guide to the Snakes and other Reptiles of Southern Africa*. Struik Publishers, Cape Town, Revised Edition, pp. 326.
- Branch, W.R., Bayliss, J. (2009): A new species of *Atheris* (Serpentes: Viperidae) from northern Mozambique. *Zootaxa* **2113**: 41–54.
- Branch, W.R., Bayliss, J., Tolley, K.A. (2014): Pygmy chameleons of the *Rhampholeon platyceps* complex (Squamata: Chamaeleonidae): Description of four new species from isolated ‘sky islands’ of northern Mozambique. *Zootaxa* **3814**: 1–36.
- Branch, W.R., Guyton, J.A., Schmitz, A., Barej, M.F., Naskrecki, P., Farooq, H., Verburgt, L., Rödel, M.-O. (2017): Description of a new flat gecko (Squamata: Gekkonidae: *Afroedura*) from Mount Gorongosa, Mozambique. *Zootaxa* **4324** (1): 142–160.
- Branch, W.R., Rödel, M.-O., Marais, J. (2005a): Herpetological survey of the Niassa Game Reserve, northern Mozambique – Part I: Reptiles. *Salamandra* **41**: 195–214.
- Branch, W.R., Rödel, M.-O., Marais, J. (2005b): A new species of rupicolous *Cordylus Laurenti* 1768 (Sauria: Cordylidae) from Northern Mozambique. *African Journal of Herpetology* **54**: 131–138.
- Branch, W.R., Tolley, K.A. (2010): A new species of chameleon (Sauria: Chamaeleonidae: *Nadzikambia*) from Mount Mabu, central Mozambique. *African Journal of Herpetology* **59**: 157–172.
- Broadley, D.G. (1966): *The Herpetology of south-east Africa*. Ph.D. thesis, Department of Zoology, University of Natal, pp. 685.
- Broadley, D.G., Howell, K.M. (1991): A check list of the reptiles of Tanzania, with synoptic keys. *Syntarsus* **1**: 1–70.
- Broadley, D.G., Measey, G.J. (2016): A new species of *Zygaspis* (Reptilia: Squamata: Amphisbaenidae) from north-eastern Mozambique. *African Journal of Herpetology* **65**: 115–122.
- Conradie, W., Bittencourt-Silva, G., Engelbrecht, H.M., Loader, S.P., Menegon, M., Nanvonamuquixo, C., Scott, M., Tolley, K.A. (2016): Exploration into the hidden world of Mozambique’s sky island forests: new discoveries of reptiles and amphibians. *Zoosystematics and Evolution* **92**: 163–180.
- Conradie, W., Bittencourt-Silva, G., Farooq, H., Loader, S. P., Menegon, M., Tolley, K.A. (2018b): New species of Mongrel Frogs (Pyxicephalidae: *Nothophryne*) for northern Mozambique inselbergs. *African Journal of Herpetology* **67**: 61–85.
- Conradie, W., Verburgt, L., Portik, D.M., Ohler, A., Bwong, B.A., Lawson, L.P. (2018a): A new Reed Frog (Hyperoliidae: *Hyperolius*) from coastal northeastern Mozambique. *Zootaxa* **4379**: 177–198.
- Dowling, H.G. (1951): A proposed standard system of counting ventral scales in snakes. *British Journal of Herpetology* **5**: 97–99.
- Engelbrecht, H.M., Branch, W.R., Greenbaum, E., Alexander, G.J., Jackson, K., Burger, M., et al. (2018): Diversifying into the branches: species boundaries in African green and bush snakes, *Philothamnus* (Serpentes: Colubridae). <https://doi.org/10.1016/j.ympcv.2018.10.023>
- Hughes, B. (1985): Progress on a taxonomic revision of African green tree snakes (*Philothamnus* spp.). In: Schuchmann, K.L. (ed.) *Proceedings of the International Symposium on African Vertebrates*. Zoologisches Forschungsmuseum Alexander Koenig, Bonn, pp. 511–530.
- Loveridge, A. (1920): Notes on East African lizards collected 1915–1919, with description of a new genus and species of skink and new subspecies of gecko. *Proceedings of the Zoological Society of London* **1920**: 131–167.
- Loveridge, A. (1951): On reptiles and amphibians for Tanganyika Territory collected by C.J.P. Ionides. *Bulletin of the Museum of Comparative Zoology, Harvard* **106**: 175–204.
- Loveridge, A. (1958): Revision of five African snake genera. *Bulletin of the Museum of Comparative Zoology, Harvard* **119**: 1–198.
- Malonza, P.K., Mulwa, D.M., Nyamache, J.O., Jones, G. (2018): Biogeography of the Shimba Hills ecosystem herpetofauna in Kenya. *Zoological Research* **39**: 97–104.
- Portik, D.M., Travers, S.L., Bauer, A.M., Branch, W.R. (2013b): A new species of *Lygodactylus* (Squamata: Gekkonidae) endemic to Mount Namuli, an isolated ‘sky island’ of northern Mozambique. *Zootaxa* **3710**: 415–435.
- Portik, D.M., Mulungu, E.A., Sequeira, D., Mcentee, J.P. (2013a): Herpetological surveys of the Serra Jeci and Namuli massifs, Mozambique, and an annotated checklist of the southern Afromontane archipelago. *Herpetological Review* **44**: 394–406.
- Rasmussen, J.B. (1981): The snakes from the rainforest of the Usambara Mountains, Tanzania: a checklist and key. *Salamandra*

17: 173–188.

- Spawls, S., Howell, K., Hinkel, H., Menegon, M. (2018a): *A Field Guide to the Reptiles of East Africa*. Bloomsbury, London, 2nd edition, pp. 624.
- Spawls, S., Bwong, B., Malonza, P., Muchai, V., Wasonga, V. (2018b): *Kenya Reptile Atlas*. Accessed May 2018 (<http://kenyareptileatlas.com/downloads.html>).
- Sternfeld, R. (1908): Neu und ungenügend bekannte afrikanische Schlangen. Sitzungsberichte der Gesellschaft Naturforschender Freunde, Berlin, 4: 92–94.
- Verburgt, L., Verburgt, U.K., Branch, W.R. (2018): A new species of *Scolecoseps* (Reptilia: Scincidae) from coastal north-eastern Mozambique. *African Journal of Herpetology*, 67: 86–98.