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# Malagasy scincid lizards: descriptions of nine new species, with notes on the morphology, reproduction and taxonomy of some previously described species (Reptilia, Squamata: Scincidae)

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**Abstract**

The taxonomy and/or natural history of 33 species of scincid lizards from Madagascar are reviewed. Most of the material, consisting of 187 specimens now housed in the Museo Regionale di Scienze Naturali, Turin, Italy, has been collected recently, but some dates to the 19th century. Nine new species are described in three genera: *Amphiglossus mandady*, *A. nanus*, *A. spilostichus*, *A. stylu*, *A. tanysoma*, *Paracontias manify*, *P. hafa*, *P. tsararano* and *Pseudoacontias menamainty*, increasing the known skink fauna of Madagascar (62 species) by 14.5%. All the new species come from the closed forests of north-eastern Madagascar. Additionally, *Amphiglossus praeornatus* is resurrected from the synonymy of *A. frontoparietalis*, and *Androngo alluaudi*, *A. crenni* and *A. elongatus* are transferred to the genus *Amphiglossus*. There is also a key to the species of *Paracontias* and a new interspecifically variable character for *Mabuya*. Information on morphological variation, basic reproductive biology, habits and habitats is provided, as available, for all species. Perhaps most interestingly, *Amphiglossus nanus* n. sp. represents the eighth skink lineage in which an oviduct has been lost and *Amphiglossus melanopleura* decreases the number of longitudinal scale rows at mid-body and the number of subdigital lamellae with altitude.

**Key words**: conservation, Madagascar, morphology, new combinations, new species, reproduction, Scincidae

## INTRODUCTION

Since the early 1990s there has been a concerted effort to inventory the fauna of Madagascar before it is degraded and destroyed. As part of this effort, F. Andreone and co-workers carried out a series of surveys, mainly in northern Madagascar, an area with a spectacular biodiversity. These surveys have revealed additional specimens of previously poorly known species as well as several new species of both frogs (Andreone, Glaw *et al.*, 1998) and reptiles (Andreone & Raxworthy, 1998; Nussbaum, Andreone & Raxworthy, 1998; Andreone, Mattioli *et al.*, 2001). Some of the most interesting and poorly known taxa found in the surveys are scincid lizards, a group which has radiated extensively on Madagascar with many genera and species but which, despite having been reviewed twice in the past 60 years (Angel, 1942 and E. R. Brygoo's series of 19 papers between 1979 and 1987), continues to harbour a surprising number of new species.

Most of the skinks collected during the recent surveys have been registered into the collections of the Museo Regionale di Scienze Naturali in Turin (MRSN) and form the core material of this report. However, the MRSN also now houses some older Malagasy skink specimens which were previously in the Museo di Zoologia dell'Università di Torino (MZUT), and these specimens are also considered here (Appendix 2). The skinks housed in the MRSN (MRSN and MZUT collections) consist of 187 specimens representing three genera of non-lygosomines: *Amphiglossus* (19 species including five that are new species), *Paracontias* (four species, including three that are new) and *Pseudoacontias* (one new species); and two genera of lygosomines: *Cryptoblepharus* (two species) and *Mabuya* (six species). In addition to the specimens housed in the MRSN, some incidental observations made by AEG on Malagasy skinks in other collections are also included.

Our purpose in this report is threefold. First, we describe nine new species of skinks discovered during recent survey work in Madagascar (Fig. 1). Second, we discuss certain aspects of the morphology, reproduction, distribution and taxonomy of some previously described species of Malagasy skinks housed in the MRSN and

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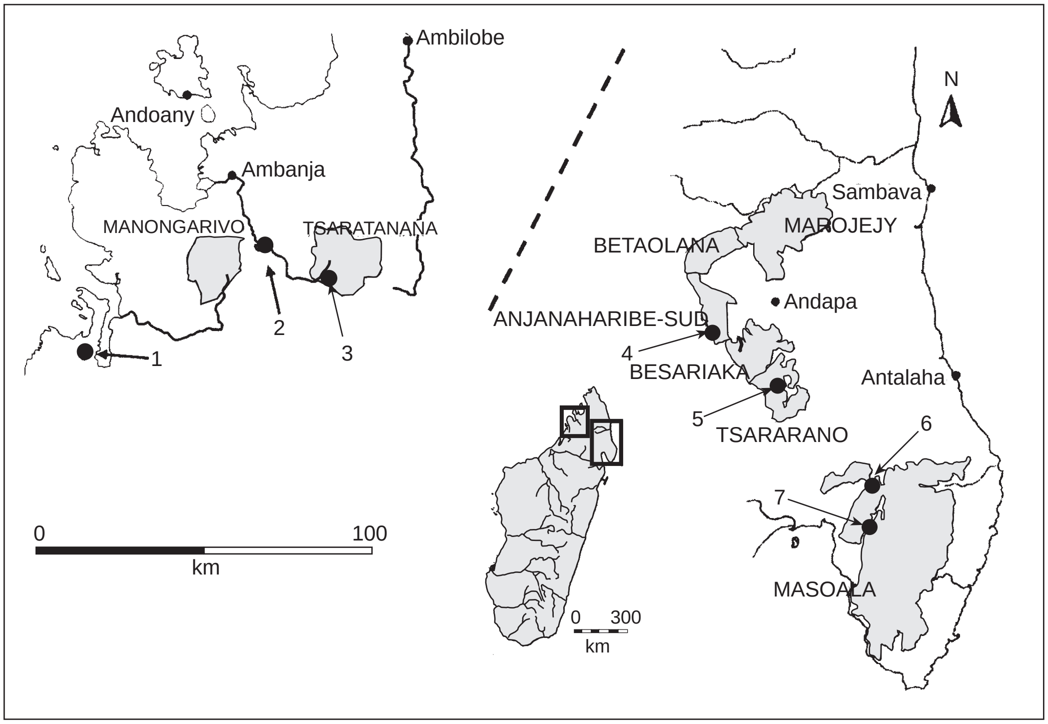

**Fig. 1.** Map of northern Madagascar with sites where the new skink species were found. Square defining north-west Madagascar: Sahamalaza Peninsula and Tsaratanana Massif, square defining north-east Madagascar: massifs around the Andapa Basin and Masoala Peninsula. 1 = Berara Forest, collection locality of *Pseudoacontias menamainty* n. sp. and *Amphiglossus tanysoma* n. sp.; 2 = Antsirasira, collecting locality of *Amphiglossus tanysoma* n. sp.; 3 = Tsaratanana Massif, collection locality of *Paracontias manify n.* sp.; 4 = Anjanaharibe-Sud Massif, collection locality of *Paracontias hafa* n. sp. and *Amphiglossus nanus* n. sp.; 5 = Tsararano Forest, collection locality of *Amphiglossus nanus* n. sp., *Amphiglossus spilostichus* n. sp. and *Paracontias tsararano* n. sp.; 6 = Andasin'i Governera Campsite, Masoala Peninsula, collection locality of *Amphiglossus nanus* n. sp.; 7 = Menamalona Campsite, Masoala Peninsula, collection locality of *Amphiglossus stylus* n. sp. and *A. mandady* n. sp. Area borders refer to the political boundaries of protected areas (RNI de Tsaratanana, PN de Marojejy, RS d'Anjanaharibe-Sud, PN de Masoala) and classified forests (Forêt de Besariaka, Forêt de Tsararano). Based upon FTM (Foiben–Taosarintanin'I Madagasikara / Institut Géographic et Hydrogéographique National) maps and a digital elaboration of GIS Service at WWF Madagascar.

other collections as described above. Third, taking into account the on-going habitat alteration and destruction in Madagascar resulting from human activity, certain aspects of conservation of Malagasy skinks are discussed, especially in terms of threatened forest habitats.

## MATERIALS AND METHODS

### Survey techniques and analysed materials

Searching included opportunistic observations and pitfall trapping. Opportunistic observations involved 2 people who were active in the field for *c.* 6 h/day (day and night). Different paths and streams were followed each day to avoid surveying old ground. The pitfall traps were buckets measuring 275 mm deep, 290 mm top internal diameter, 220 mm bottom internal diameter with the handles removed and 2 mm diameter holes punched in the bottom to allow drainage. The buckets were sunk in the ground at 10-m intervals along a plastic drift fence 0.5 high and 100 long. The fence was stapled to wooden stakes, its lower edge buried 50 mm deep into the ground and positioned to run across each pitfall trap. The traps were checked each morning and evening. Three fence lines were placed in different forest types: ridge (along the crest of a ridge), slope (on a gradient) and valley (within 20 of a stream in a valley bottom).

Representative individuals of almost all the species were photographed to document their colour in life. Voucher specimens were anaesthetized, killed with an injection of chlorobuthanol solution or exposure to ether, fixed in 4% buffered formalin or 90–100% ethanol and transferred to 70–75% ethanol. Collected material has been deposited at the Museo Regionale di Scienze Naturali, Torino, Italy and the Parc Botanique et Zoologique de Tsimbazaza, Antananarivo, Madagascar.

A complete list of the specimens collected during recent field surveys by F. Andreone and collaborators and historical specimens from the Museo di Zoologia dell'Università di Torino (both housed in Museo Regionale di Scienze Naturali, Torino) is given in Appendix 1.

**Fig. 2.** *Amphiglossus spilostichus* n. sp. Holotype: MRSN R1737; SVL = 79 mm.

Latitude and longitude is given in degrees, minutes and decimal fractions of seconds.

## Morphological analysis and character counts

The specimen analysis, including comparison with types, was done by AEG. Snout–vent length (SVL) was measured to the nearest 0.5 mm by applying the ventral side of the specimen to a steel rule. Head length was measured to the nearest 0.01 mm by applying vernier callipers between the tip of the snout and the centre of the external ear opening. Limb length (claw excluded) was measured to the nearest 0.5 mm by applying the posterior edge of the extended limb (normal to body or base of tail) to a steel rule.

Sex and reproductive status were determined by direct observation of the gonads and efferent ducts through an incision in the posterior part of the body wall. The colour of the parietal peritoneum and the presence or absence of an inguinal fat body were also assessed through this incision.

The number of pre- and postsacral vertebrae as well as other skeletal features were assessed from radiographs made on Kodak Industrex® film with a machine setting of 30 kV for 45–70 s depending on the size of the specimen.

The following scale definitions were used:

(1) the *nuchals* are the total (bilateral) number of contiguous paravertebral scales directly posterior to the parietal that are appreciably wider than the more posterior paravertebrals;

(2) the *paravertebrals* are counted in a single row from the first scale posterior to a line connecting the posterior edges of the thighs held normal to the long axis of the body anteriorly to and including the nuchals

(3) the *ventral scales* are counted in a single row between the mental and preanal scales, inclusive;

(4) the *most posterior infralabial* is the one apposing the last supralabial without extending posterior to it;

(5) the *subdigital lamellae* are defined as all those scales on the ventral surface of the fourth digit of the pes that are appreciably wider than the scales over the fleshy part of the sole but exclusive both of any wide scales extending beyond the digit onto the fleshy part of the sole and any small scales on the very base of the digit.

Variable bilateral scale counts on individual specimens are reported as: left/right. The number of digits and the phalangeal formulas for the manus and pes are reported as: manus/pes.

For phylogenetic inferences, morphological character states have been polarized using the most generally primitive group of skinks, the genus *Eumeces*, especially the subgenus *Pariocela* (Greer & Broadley, 2000).

## Acronyms

The museum acronyms used throughout the text are as follows: BMNH, Natural History Museum, London (formerly the British Museum of Natural History); MNHN, Muséum national d'Histoire naturelle, Paris; MRSN, Museo Regionale di Scienze Naturali, Torino; MZUT, Museo di Zoologia dell'Università di Torino (collection now housed at the MRSN); ZFMK, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn; ZSM, Zoologische Staatssammlung München. Protected areas are quoted throughout the text as follows: RS = Réserve Spéciale (Special Reserve);

PN = Parc National (National Park); RNI = Réserve Naturale Intégrale (Strict Nature Reserve).

## RESULTS

### Description of new species

### *Amphiglossus spilostichus* n. sp.

(Figs 2–3)

### *Holotype*

MRSN R1737, adult male, fixed in 4% formalin and preserved in 70% ethanol, collected at Tsararano Forest, Campsite 2 (Andatony Anivo), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.8′S, 49°42.6′E, 650 m, on 9 December 1996, by F. Andreone and J. E. Randrianirina.

### *Paratype*

MRSN R1738, male, fixed in 4% formalin and preserved in 70% ethanol, collected at Tsararano Forest, Campsite 2 (Andatony Anivo), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.8′S, 49°42.6′E, 650 m, on 15 December 1996, by F. Andreone and J. E. Randrianirina.

### *Diagnosis*

Distinguished from all other *Amphiglossus* except *A. mandady* n. sp. (below) in having a colour pattern of pale dashes arranged linearly through the centres of the otherwise brown scales on the dorsum, sides of the neck and anterior body. Differs from *A. mandady* most noticeably in having longitudinal scale rows at midbody 27–30 *vs* 24 (see *A. mandady* for further distinguishing characters).

### *Description*

*External morphology.* In general appearance, a medium-sized skink (maximum SVL = 81.5 mm) with moderately well-developed limbs and a medium brown ground colour with a series of pale dashes through the centres of each dorsal and lateral scale row on the neck and trunk, most well defined on dorsum of neck and anterior body and on flanks.

Snout bluntly rounded in both lateral and medial aspect; rostral band-like with only slight posteromedial projection onto dorsum of snout; supranasals in contact; frontonasal wider than long; prefrontals absent; frontal constricted anteriorly by first supraocular, that is, frontal hourglass-shaped (Greer & Shea,

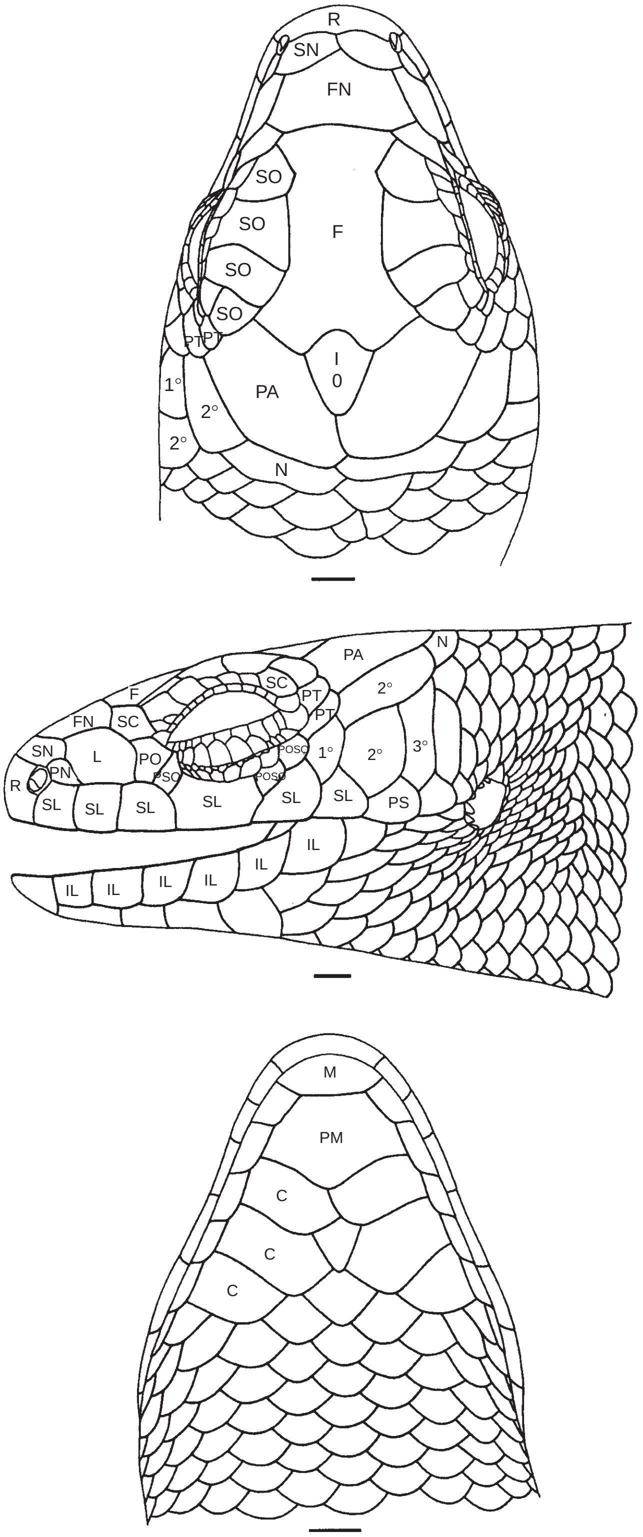

**Fig. 3.** Head scales of *Amphiglossus spilostichus* n. sp. (holotype: MRSN R1737) in dorsal, lateral and ventral view. Scale bar = 1 mm.

2000); supraoculars four, first constricting frontal, all four contacting frontal; frontoparietals absent; interparietal present, well separated from supraoculars; parietal eyespot present with parietal eye evident; parietals contact posterior to interparietal; nuchals a single pair.

Nasal an anteriorly open crescent, just slightly larger than nostril; nostril bordered by short section of rostral anteriorly and by small, crescentic nasal elsewhere; postnasal present, in narrow contact with second supralabial; loreal single, about as deep as long; preocular single; presubocular single; supraciliaries seven (three sides) or eight (one side), in continuous row, first contacting frontal strongly, first three contacting first supraocular, last projecting onto supraocular shelf; upper palpebrals small except for last which projects dorsomedially slightly; pretemporals two, both contacted by parietal; postsuboculars two, upper contacting lower pretemporal, both contacting penultimate supralabial; lower eyelid moveable, scaly; lower palpebrals small, longer than deep, interdigitating with large columnar scales of central eyelid; contact between upper palpebrals and supraciliaries direct but flexible, i.e. palpebral cleft narrow; primary temporal single; secondary temporals two, upper long, contacting lower pretemporal anteriorly and nuchal posteriorly and overlapping lower secondary temporal ventrally; tertiary temporal bordering lower secondary temporal single; supralabials six, fourth subocular and contacting scales of lower eyelid; postsupralabial single; external ear opening large (approximately half size of eye opening), circular to vertically suboval, with short, narrow, blunt lobules anteriorly and extending variably around rest of auricular rim.

Mental appreciably wider than long; postmental wider than long, contacting two infralabials; infralabials six; three pairs of large chin scales, members of first pair in contact, members of second pair separated by one scale row, and members of third pair separated by three scale rows; genials do not extend between infralabials and large chin scales.

Body scales cycloid, smooth, with single row of minute pits along posterior edge of each dorsal and lateral scale; longitudinal scale rows at mid-body 27–30; paravertebrals 70–72, except for nuchals, similar in size to adjacent scales; ventrals 70–71; inner preanals overlap outer; scales of midventral caudal series similar in size to more adjacent scales.

Both pairs of limbs pentadactyl; as a proportion of SVL, front limb 21% (15.5–17.0 mm) and rear limb 30–32% (24.0–25.0 mm); subdigital lamellae beneath fourth digit of pes, 21 (two with complete digits), not counting one or two rows of small scales at base of digits.

SVL 79–81.5 mm, 5.9–6.1 times head length (13.3 mm); tail 109–130 mm (both regenerated).

*Soft anatomy*. Inguinal fat bodies present.

*Skeletal features*. Premaxillary teeth seven ($n = 2$); crowns of teeth bluntly rounded; hyoid elements resolvable on radiographs include ceratohyal and ceratobranchials I and II; presacral vertebrae 34 ($n = 2$); cervical vertebrae, eight; caudal vertebrae's transverse processes project anterolaterally at an angle between *c.* 5° and 30°; free ribs begin on fourth presacral vertebra; ribs lack accessory processes; sternal/mesosternal ribs 3/2; mesosternum small, rhomboidal with central opening; complete inscriptional chevrons, four; phalangeal formula of manus 2.3.3.4.3 and of pes 2.3.4.5.4.

*Colour in life*. The colour in life is similar to colour in preservative as described below. There were no obvious chromatic hues.

*Colour in preservative*. Ground colour of body dark brown dorsally becoming greyish brown laterally and dingy pale brown ventrally. Most dorsal and lateral scales with a very pale brown central spot confined to base of each scale on dorsum but becoming a central dash on flanks, resulting in an overall pattern of a series of subtle longitudinal pale spots dorsally but becoming a series of strong longitudinal dashes laterally. On head, scale edges tend to be dark brown and scale centres tend to be medium to pale brown. Venter completely pale, e.g. without pattern.

Parietal peritoneum pale; tongue dark over distal third and pale over proximal two-thirds.

*Details of holotype* (MRSN R1737). In those characters that vary, the holotype has the following conditions: SVL = 79 mm; supraciliaries 7/8; longitudinal scale rows at mid-body 29; paravertebral scales 70; ventral scales 71; second digit of right pes and fourth digit of left pes missing distal sections; tail regenerated, part of tail detached (94 mm), remaining part of attached tail (34 mm) partially broken.

## *Etymology*

The species name is derived from the Greek words for 'spot' (*spilos*) and 'stripe' (*stichos*) to call attention the linearly spotted pattern of the species.

## *Distribution*

So far the species is known only from Tsararano, although it is likely to occur at other low and mid-altitude sites of north-eastern Madagascar.

## *Habitats and habits*

The Tsararano Chain lies south of the Andapa Basin, midway between the Anjanaharibe-Sud Massif and the Masoala Peninsula and is formed by several hills (altitude 400–1269 m). The forest of Tsararano appears to be relatively intact, most probably because of the distance from large villages. Little can be said about the habits of the species. The two specimens were caught in pitfall traps between the late afternoon and morning trap checks and hence the species is likely to be crepuscular and/or nocturnal.

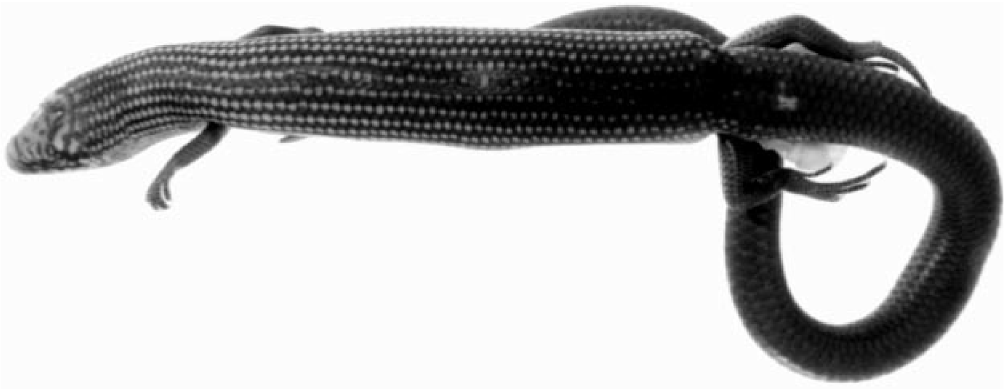

**Fig. 4.** *Amphiglossus mandady* n. sp. Holotype: MRSN R1717; SVL = 62 mm.

### *Amphiglossus mandady* n. sp.

(Fig. 4)

#### *Holotype*

MRSN R1717, adult male, fixed in 4% formalin and preserved in 70% ethanol, collected at Masoala Peninsula, Campsite 5 (Menamalona), Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 15°22.87′S, 49°59.27′E, 780 m, on 19 December 1999, by F. Andreone and J. E. Randrianirina.

#### *Diagnosis*

Very similar to preceding species but differing in the following features: supraciliaries 6 (*vs* 7–8); longitudinal scale rows at mid-body 24 (27–30); paravertebrals 69 (70–72); ventrals 73 (70–71); subdigital lamellae 19–20 (21); presacral vertebrae 36 (34); SVL 62 mm (79–81.5 mm), 6.3 (5.9–6.1) times head length (9.8 mm); as proportion of SVL, front limb 17% (21) and rear limb 27% (31–32), i.e. limbs relatively smaller considering that intraspecifically, smaller individuals usually have relatively longer limbs; underside of tail dark brown (pale).

#### *Description*

External morphology. Very similar to *Amphiglossus spilostichus* except as noted in the diagnosis.

*Colour in life*. The species is dark brown-reddish dorsally, with a small pale spot or dash in the centre of each scale. The belly is likely pale yellowish.

*Colour in preservative*. Similar to *Amphiglossus spilostichus*, but generally darker brown and with the pale dashes extending more posteriorly on body.

#### *Etymology*

The Malagasy word ‘mandady’ means, in general, ‘to creep’ or ‘creeping’. This is an attribute of the typical locomotory behaviour of the *Amphiglossus* skinks, including this new species. The phonetic rendition is: man*dad*–ee (accented syllables italicized).

#### *Distribution*

The species is currently known only from Menamalona, Masoala Peninsula. However, it could be present in the other low altitude rainforests in north-east Madagascar.

#### *Habitats and habits*

The single specimen was found in low altitude rainforest that is fairly typical in north-east Madagascar and which to date is not very disturbed or exploited. Little is known of the species’ habits. The only available specimen fell into a pitfall trap overnight, suggesting that the species is nocturnal.

#### *Comments*

This species seems to be slightly more elongate and limb-reduced than *Amphiglossus spilostichus* in that it has a slightly higher number of presacral vertebrae and slightly shorter limbs.

### *Amphiglossus nanus* n. sp.

(Figs 5–7)

#### *Holotype*

MRSN R1803, adult male, fixed in 4% formalin and preserved in 70% ethanol, collected at Anjanaharibe-Sud Massif, Analabe Valley, Campsite W1, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46′S, 49°27′E, 1000 m, on 28 January 1996, by F. Andreone, H. Randriamahazo and J. E. Randrianirina.

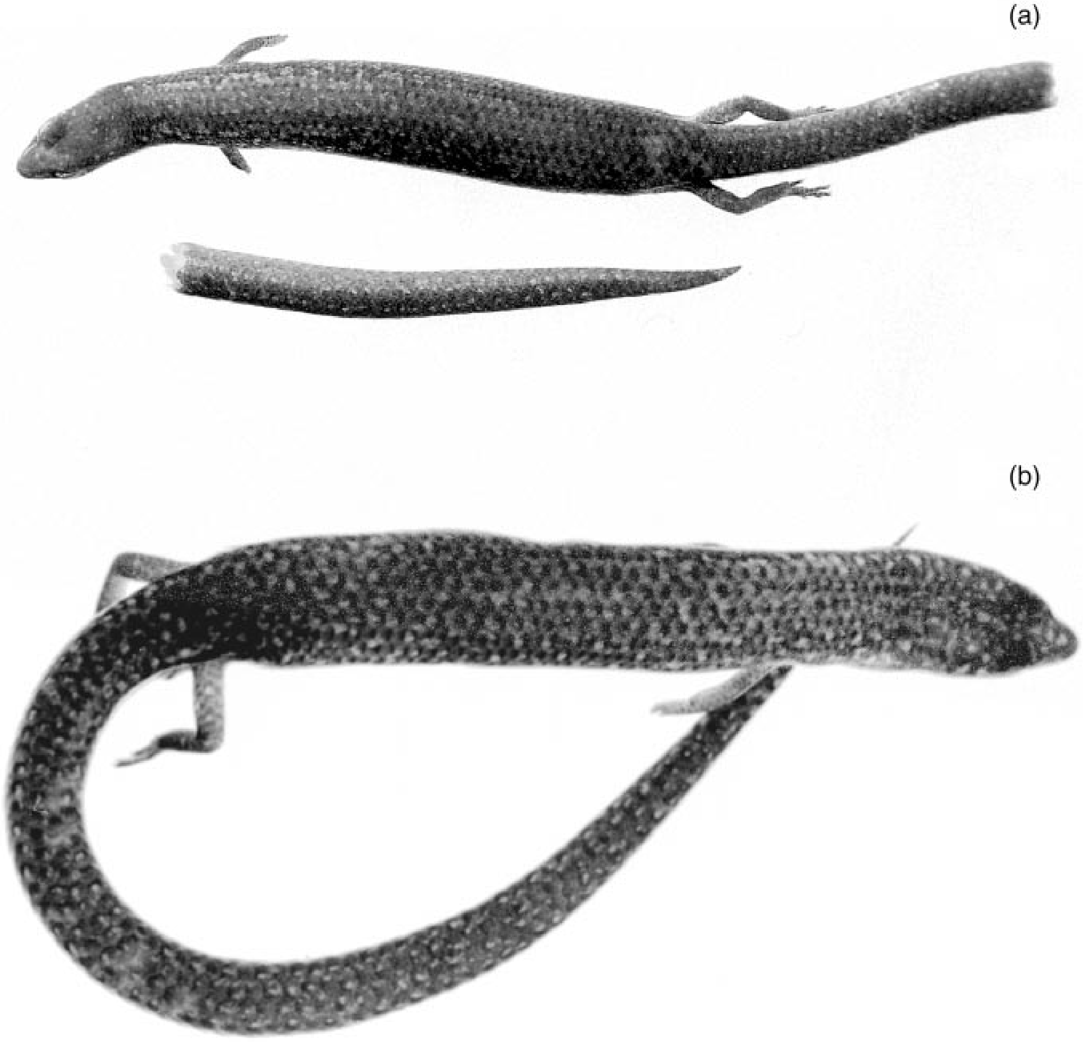

**Fig. 5.** *Amphiglossus nanus* n. sp. (a) paratype: MRSN R1740; SVL = 28.5 mm; (b) paratype: MRSN R 1802; SVL = 25 mm.

### *Paratypes*

MRSN R1802, male, fixed in 4% formalin and preserved in 70% ethanol (as were all other paratypes), collected at Anjanaharibe-Sud Massif, Analabe Valley, Campsite W1, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46′S, 49°27′E, 1000 m, on 28 January 1996, by F. Andreone, H. Randriamahazo and J. E. Randrianirina; MRSN R1804 and MRSN R1805, female and male, collected at Anjanaharibe-Sud Massif, Analabe Valley, Campsite W2, Befandriana Fivondronana, Mahajana Faritany (Majunga Province), 14°46′S, 49°26′E, 1250 m, on 5 February 1996, by F. Andreone, H. Randriamahazo, and J. E. Randrianirina; MRSN R1739, female, collected at Tsararano Forest, Campsite 2 (Andatony Anivo), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.8′S, 49°42.6′E, 600 m, on 9 December 1996, by F. Andreone and J. E. Randrianirina; MRSN R1740, female, collected at Tsararano Forest, Campsite 2 (Andatony Anivo), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.8′S, 49°42.6′E, 600 m, on 11 December 1996, by F. Andreone and J. E. Randrianirina; MRSN R1806, female, collected at Anjanaharibe-Sud Massif, Analabe Valley, Campsite W2, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46′S, 49°26′E, 1250 m, on 5 February 1996, by F. Andreone, H. Randriamahazo and J. E. Randrianirina; MRSN R1870-72, male, collected at Masoala Forest, Campsite 3 (Andasin'i Governera), Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 15°18.55′S, 50°0.22′ E, on 5 December 1998, by F. Andreone and J. E. Randrianirina.

### *Diagnosis*

Differs from all other species of *Amphiglossus* except *A. macrolepis* (holotype and only known specimen examined: BMNH 1946.8.21.23) by its very small size (SVL < 33.5 mm) and loreal not extending ventrally to supralabial row. Distinguished from *A. macrolepis* by its possibly even smaller size, with maximum SVL of

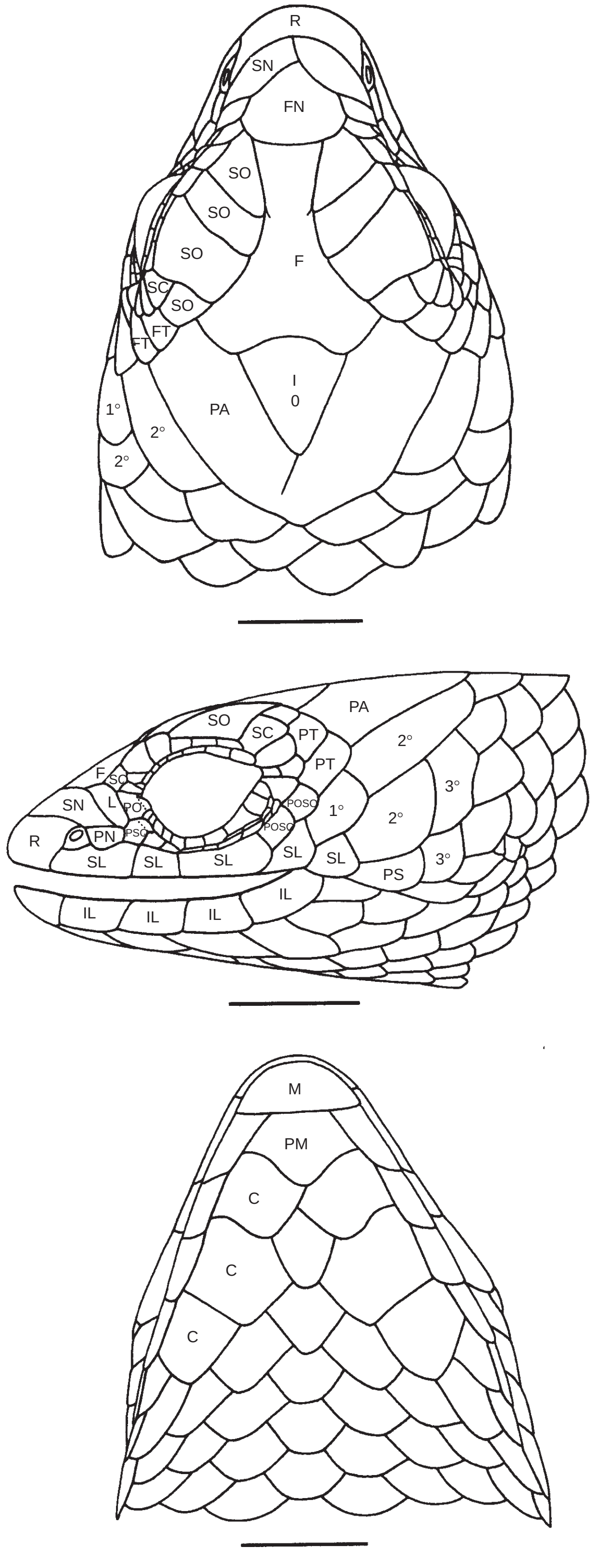

**Fig. 6.** Head scales of *Amphiglossus nanus* n. sp. (holotype: MRSN R1803) in dorsal, lateral and ventral view. Scale bar = 1 mm.

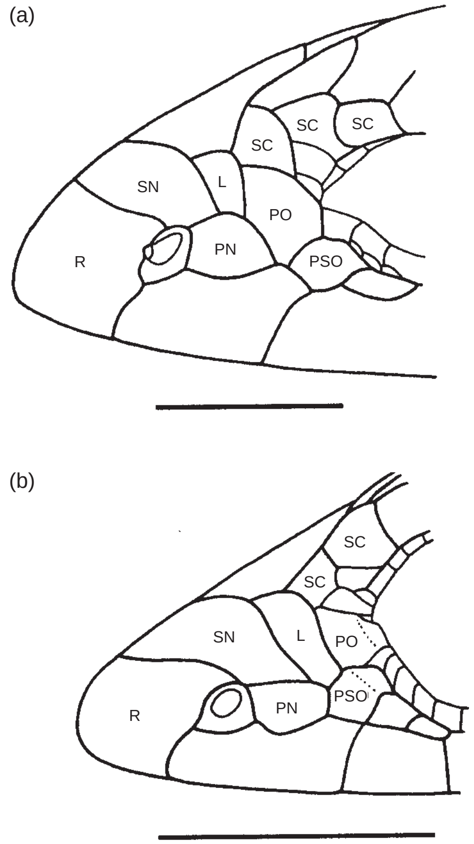

**Fig. 7.** Detail of left preocular area of two small *Amphiglossus*. (a) *A. macrolepis* (holotype: BMNH 1946.8.21.23); (b) *A. nanus* (holotype: MRSN R1803). Scale bar = 1 mm.

29 mm instead of 33.5 mm; separation of loreal from supralabial row by contact between postnasal and enlarged presubocular instead of by contact between postnasal and preocular (Fig. 7); scales between lower secondary temporal and ear opening two instead three; longitudinal scale rows at mid-body 20 instead of 18, and subdigital lamellae on fourth digit of pes 6–9 instead of 5.

## *Description*

*External morphology.* In general aspect, a very small (maximum SVL = 29 mm), slender, medium brown skink with small limbs.

Snout subacutely rounded in lateral aspect and broadly rounded in dorsal aspect; rostral a crescentic band across tip of snout; supranasals in contact; prefrontals absent; frontal constricted anteriorly by first supraocular, i.e. hourglass-shaped (Greer & Shea, 2000); supraoculars four, first constricting frontal, all contacting frontal; frontoparietals absent; interparietal present, well separated from supraoculars; parietal eye present; parietals meet posterior to interparietal; transversely large nuchals 0/0 to 3/3.

Nasal very small, crescentic; nostril bordered by nasal except anterodorsally where it is bordered by rostral; postnasal present; loreal single, much deeper than long and displaced dorsally by contact between postnasal and presubocular; preocular single but reduced ventrally, allowing loreal to contact presubocular; presubocular single; supraciliaries six (11.8% of 17 bilateral cases), seven (64.7%) or eight (23.5%), in continuous row, first well separated from frontal except in one case (5% of 20 cases), first two (75% of 20 cases) or three (25%) contacting first supraocular, last large and projecting into supraocular space (and hence reducing relative size of fourth supraocular); upper palpebrals small except for last which projects medially posterior to last (also projecting) supraciliary; contact between upper palpebrals and supraciliaries direct and flexible, i.e. palpebral cleft narrow; pretemporals two; postsuboculars two, both contacting penultimate supralabial; lower eyelid scaly and moveable; lower palpebrals small, longer than deep; primary temporals one (85% of 20 cases) or two (15%); secondary temporals two, upper secondary temporal contacting lowermost pretemporal anteriorly and anteriormost nuchal posteromedially and overlapping lower secondary temporal ventrally; tertiary temporals bordering lower secondary temporal two; scales between lower secondary temporal and external ear opening two; supralabials five, third subocular, contacting scales of lower eyelid; postsupralabial single; external ear opening very small (no more than twice size of external naris), without lobules.

Mental wider than long; postmental contacting one infralabial on each side; infralabials four; three pairs of large chin scales, members of first pair in contact, members of second pair separated by one scale row, and members of third pair separated by three scale rows; chin scales abut infralabials, i.e. genials do not encroach between chin scales and infralabials.

Body scales cycloid, smooth; longitudinal rows at mid-body 20; paravertebrals 48–57, except for nuchals, similar in size to adjacent scales; ventrals 59–63; inner preanals overlap outer, medial pair relatively large; males with large, keeled postanal scale, females with this scale only slightly larger than adjacent scales.

Manus with digits five or four, first digit varying from short and clawed (MRSN R1739-1740) to a minute clawless nubbin; pes pentadactyl, all digits clawed; subdigital lamellae smooth, on fourth digit of pes, 6–9.

SVL 22–29 mm, 5.3 to 6.5 times head length (3.9–4.8 mm); tail length (complete) 1.23 to 1.42 times SVL ($n = 2$); as proportion of SVL, front leg 12–18% (3.0–4.0 mm) and rear leg 17 to 22% (4.7–6.0 mm).

*Soft anatomy*. In three of the four females, the right oviduct and ovary are absent while in one female (MRSN R1804) the right ovary is present but the right oviduct is absent. Therefore, it seems as if the species may be characterized by the absence of the right oviduct and variable presence of the right ovary. Inguinal fat bodies present.

*Skeletal features*. Premaxillary teeth 10 ($n = 1$); crowns of teeth bluntly rounded to bluntly pointed; in bony secondary palate, each palatal ramus of the pterygoids with deep recurved process, i.e. a beta palate (Greer, 1974); sternum with three attached ribs (from presacral vertebrae 9–11); mesosternum thin, probably solid, with slight medial expansion and two attached ribs (from presacral vertebrae 12–13); presacral vertebrae 31–34 (mean = 32.5, $n = 10$); postsacral vertebrae 41–42 ($n = 2$); cervical vertebrae eight; caudal vertebrae's transverse processes project anterolaterally at approximately 45°; free ribs begin on fourth presacral vertebra; all ribs smooth sided, i.e. without accessory processes; phalangeal formula of manus cannot be determined from the radiographs, but phalangeal formula for pes 2.3.4.4.3.

*Colour in life*. Nothing recorded.

*Colour in preservative*. Dorsum of head, body and tail medium brown lightly variegated with pale brown, on body, dark brown tending to aggregate in centres of scales; venter of head and body pale; venter of tail brown. Tongue pale basally, dark distally. Parietal peritoneum pale.

*Details of holotype* (MRSN R1803). In those characters that vary, the holotype has the following conditions: SVL = 23.5 mm; supraciliaries 7/7, 2/3 contacting first supraocular; nuchals 0/0; primary temporals 1/1; subdigital lamellae 7/7; paravertebrals 56; ventrals 60; presacral vertebrae 32; head length 4.2 mm; digits 4/5; front limb length 4.0 mm and rear limb length 5.0 mm.

## *Etymology*

The species name is derived from the Greek word for 'small' or 'dwarf' (*nanos*) and draws attention to the very small size of the species among not only Malagasy skinks but skinks in general. Indeed, for skink species represented by five or more specimens, this species and two others are second only in small size to *Menetia maini* with a maximum SVL of 28 mm. The other two species which share *Amphiglossus nanus*' maximum SVL of 29 mm are the Australian species *Menetia alanae* and *M. timlowi* (Greer, 2001).

## *Distribution*

This new small species has been found, to date, at some mid-altitude rainforests in north-east Madagascar, such as Anjanaharibe-Sud, Tsararano and Masoala. The species was not found at Besariaka, possibly because this site was surveyed during a cold period (June). A study carried out by Raselimanana, Raxworthy & Nussbaum (2000) at Marojejy identified specimens as *A. minutus*. The possibility that these specimens are actually *A. nanus* n. sp. merits investigation.

## *Habitats and habits*

The species seems to be associated with intact rainforests at mid-altitudes. All the specimens were captured

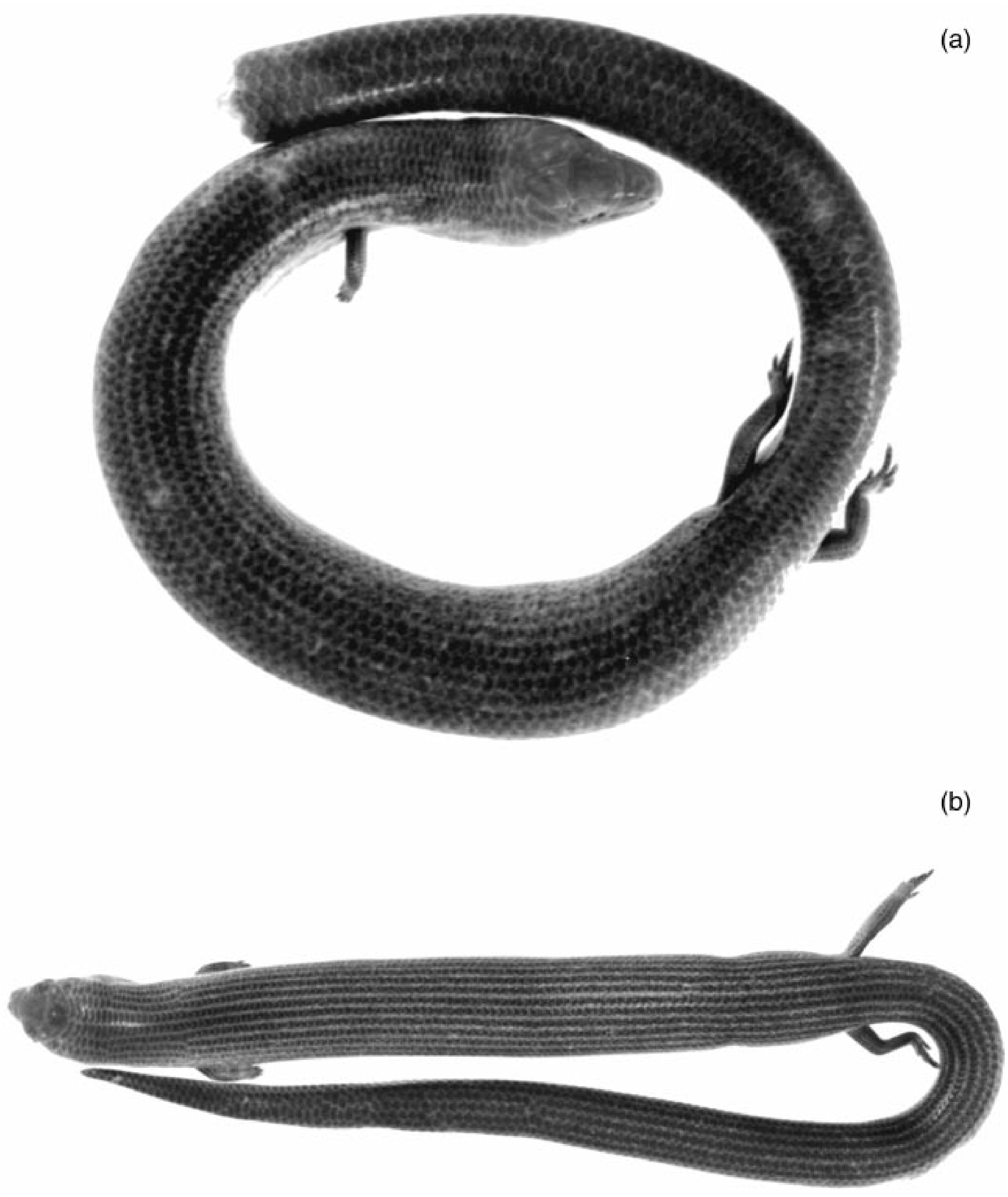

**Fig. 8.** *Amphiglossus tanysoma* n. sp. (a) Holotype: MRSN R1729; SVL = 103 mm; (b) paratype: MRSN R1865; SVL = 75 mm.

in pitfall traps. The species was never encountered in opportunistic searching, probably because of its small size and possible cryptozoic habits.

### *Reproduction*

Two females measuring 25.0 and 28.5 mm SVL (MRSN R1739 and R1740, respectively) each contain a single enlarged follicle in the left (sole) ovary, suggesting a brood size of one. The two largest males with SVLs of 23.5 (MRSN R1803) and 25 mm (MRSN R1802) seem to be mature to judge from the relatively large and turgid testes.

Among lygosomine skinks, an oviduct has been lost at least seven times, and in all cases it has been the left oviduct that has been lost (Greer, 1977; Greer & Mys, 1987) and not the right as in *A. nanus*. Furthermore, as far as is known, in lygosomines loss of an oviduct is associated with the reduction in the brood size to one. This association also seems to also apply to *A. nanus*. In the lygosomines, it was inferred that under the constraint of diminishing size, the left oviduct was lost due to the presence of the stomach on this side. But what factor may have caused the right oviduct to be lost in *A. nanus* is unclear, as the distribution of the internal organs in this species is not noticeably different to that in the lygosomines.

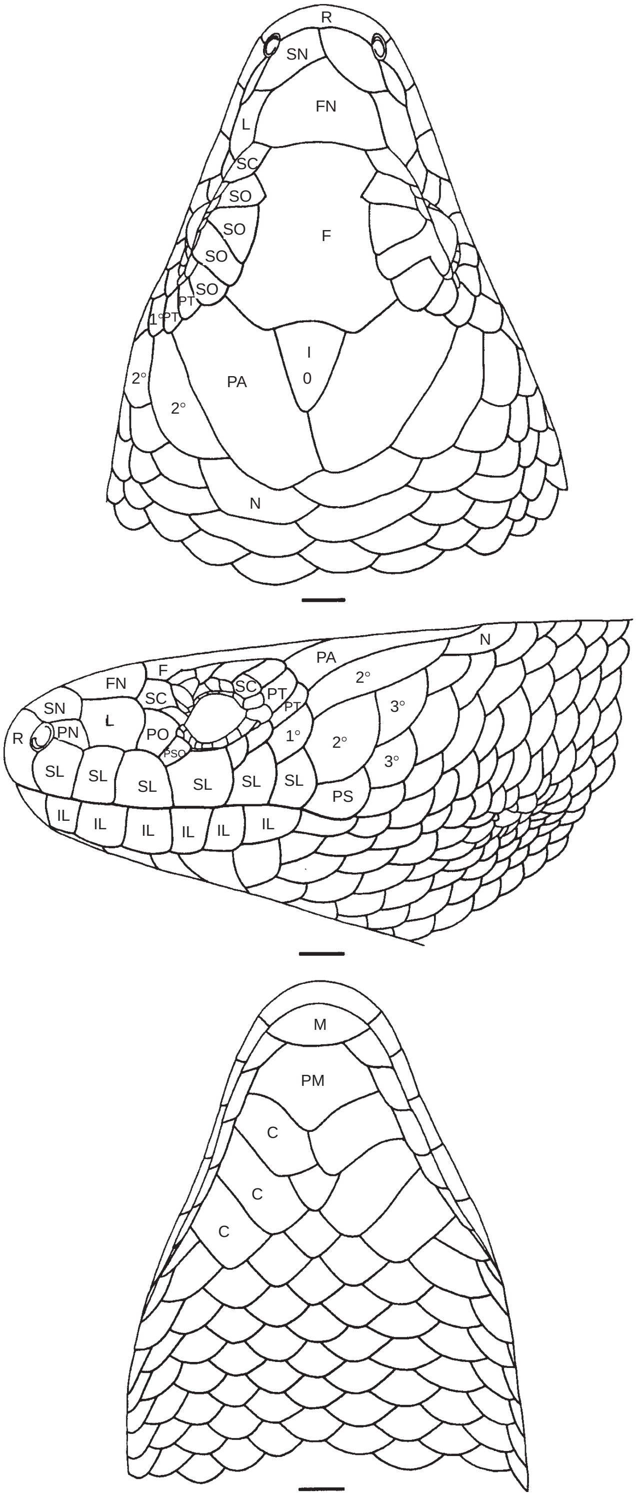

**Fig. 9.** Head of *Amphiglossus tanysoma* n. sp. Holotype (MRSN R1729) in dorsal, lateral and ventral view. Scale bar = 1 mm.

### *Comments*

In their study at Anjanaharibe-Sud, Raxworthy *et al.* (1998) and later Andreone, Randrianirina *et al.* (2000), assigned these and other specimens to *Amphiglossus minutus*. Therefore, the current re-identification suggests that *A. minutus* is a species restricted to Sambirano, while *A. nanus* is from the eastern escarpment (but see comments above regarding specimens from Marojejy). *Amphiglossus nanus* can be readily distinguished from *A. minutus* by its smaller size (maximum SVL = 29 mm *vs* 39 mm); loreal and supralabial row relationship (loreal displaced off the supralabial row instead of in contact); fewer supralabials (five *vs* six); more ventral scales (59–63 *vs* 48–52); fewer subdigital lamellae (6–9 *vs* 10–11) and more presacral vertebrae (31–34 *vs* 29–30).

## ***Amphiglossus tanysoma*** **n. sp.**

(Figs 8 & 9)

### *Holotype*

MRSN R1729, adult female, fixed in 4% formalin and preserved in 70% ethanol, collected at Berara Forest, Sahamalaza Peninsula, Analalava Fivondronana, Mahajanga Faritany (Majunga Province), 14°18.55′S, 47°54.92′E, 170 m, on 22 February 2000 by F. Andreone, J. E. Randrianirina and M. Vences.

### *Paratypes*

MRSN R1865, immature male, collected at Antsirasira, Marovato Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 13°56.37′S, 48 33.27′E, < 100 m, on 30 January 2001 by F. Andreone, F. Mattioli, J. E. Randrianirina and M. Vences.

ZSM 526/2001, immature female, collected at Ankarafantsika, Mahajanga Faritany (Majunga Province), in February 2001 by M. Vences, D. Vieites, G. Garcia, V. R. Raherisoa and A. Rasoamamonjinirina.

### *Diagnosis*

Differs from all other *Amphiglossus* in having limbs pentadactyl, longitudinal scale rows at mid-body 26–28, presacral vertebrae ≥ 52 and phalangeal formula: 2.2.3.3.2/ 2.3.3.4.3.

### *Description*

*External morphology.* In general appearance, a dorsally brown skink of moderate length (maximum SVL = 103 mm) and medium girth with relatively short pentadactyl limbs.

Snout bluntly rounded in both lateral and medial aspect; rostral band-like with dorsomedial edge gently posteriorly concave; supranasals in contact; frontonasal wider than long; prefrontals absent; frontal constricted anteriorly by first supraocular, that is, frontal hourglass-shaped (Greer & Shea, 2000); supraoculars four, first constricting frontal, all contacting frontal; frontoparietals absent; interparietal present, well separated from supraoculars; parietal eyespot present; parietals in contact posterior to interparietal; nuchals 2/2– 2/3.

Nasal an anteriorly open crescent, just slightly larger than nostril; nostril bordered by short section of rostral anteriorly and by small, crescentic nasal elsewhere; postnasal present, in moderate contact with second supralabial; loreals usually one (83% of six cases), slightly longer than deep but occasionally (17%) two; preocular single; presubocular single; supraciliaries 6 (83% of six cases) or 7 (17%), in continuous row, first contacting frontal strongly, first three contacting first supraocular, last projecting onto supraocular shelf; upper palpebrals small except for last which projects dorsomedially slightly; upper palpebrals contact supraciliaries directly across only very thin palpebral cleft; pretemporals two, both contacted by parietal; postsuboculars two (66% of six cases) or one (34%), when two both contacting penultimate supralabial and upper contacting lower pretemporal; lower eyelid moveable, scaly; lower palpebrals small, longer than deep, interdigitating with larger scales of central eyelid; primary temporal single; secondary temporals two, upper long, contacting lower pretemporal anteriorly (except on right side of MRSN R1865) where primary temporal contacts, probably anomalously, parietal thereby separating upper secondary temporal and lower pretemporal) and nuchal posteriorly and overlapping lower secondary temporal ventrally; tertiary temporals bordering lower secondary temporal two; supralabials six, fourth subocular and contacting small scales of lower eyelid; postsupralabial single; external ear opening small (approximately one and a half to four times nostril opening), vertically circular to oval dipping slightly anteriorly, with one or no short fleshy lobules anteriorly.

Mental appreciably wider than long; postmental only slightly wider than long, contacting two infralabials bilaterally; infralabials six; three pairs of large chin scales, members of first pair in contact, members of second pair separated by one scale row, and members of third pair separated by three scale rows; genials do not extend between infralabials and large chin scales.

Body scales cycloid, smooth, with minute pits arranged in either a single row or in small clusters along posterior edge of each dorsal and lateral scale; longitudinal scale rows at mid-body 26–28 (mode = 28); paravertebrals 109–114 (mean = 111.7), except for nuchals, similar in size to more lateral scales; ventrals 107–111 (mean = 109.7); inner preanals overlap outer; postanal scale in males large and with slight bos; scales of midventral caudal series similar in size to more adjacent scales.

Both pairs of limbs pentadactyl; as a proportion of SVL, front limb 6–9% (6.0–6.8 mm) and rear limb 11–15% (10.5–11.5 mm); scales on dorsal surface of fourth digit of pes in multiple rows except for most distal 2–3 scales which are single; subdigital lamellae beneath fourth digit of pes 8–9.

SVL 75–103 mm, 7.3–8.5 times head length (9.8–12.1 mm); unregenerated tail length as proportion of SVL $\geq 0.96$ and regenerated tail length $\geq 1.31$.

*Soft anatomy*. Inguinal fat bodies present.

*Skeletal features*. Premaxillary teeth seven ($n = 2$); crowns of teeth bluntly rounded; hyoid elements resolvable on radiographs include ceratohyal and ceratobranchials I and II; presacral vertebrae 52–53 (mode = 52); cervical vertebrae eight; free ribs begin on fourth presacral vertebra; anterior caudal vertebrae's transverse processes project anteriorly at angle of *c*. 45–50°; caudal autotomy plane passes through anteromedial part of transverse process; ribs lack accessory processes; sternal/mesosternal ribs 3/2; mesosternum small, rhomboidal with central opening either small or absent (cannot be resolved on radiographs); complete inscriptional chevrons 13–15; phalangeal formula of manus 2.2.3.3.2 and of pes 2.3.3.4.3.

*Colour in life.* The holotype had a dorsal background brownish shading to pinkish. On the flanks the background colour became pale yellowish brown with darker brown speckling. The belly was almost whitish. The legs were the same colour as the dorsum.

*Colour in preservative.* Ground colour of body dark brown dorsally becoming greyish brown laterally and dingy pale brown ventrally. On closer inspection, dorsum of body with slightly darker pigment oriented through centres of scales becoming more diffuse on flanks. This dark central colour containing myriad small patches of paler ground colour. Head nearly uniformly brown dorsally and laterally but becoming pale ventrally, darkest on snout. Venter of body unpatterned except for a few scattered small brown spots. Tail brown above becoming paler ventrally but remaining darker than venter of body. Tongue medium grey anteriorly, pale posteriorly. Parietal peritoneum pale.

*Details of holotype* (MRSN R1729). In those characters that vary, the holotype has the following conditions: SVL = 103 mm; supraciliaries 7/6; nuchals 2/3; postnasal contacts second supralabial bilaterally; external ear opening approximately one and a half times nostril opening; paravertebral scales 112; ventral scales 111; as proportion of SVL, front limb 6% (6.0 mm) and rear limb 11% (11.0 mm); SVL 8.5 times head length; tail remaining after autotomy 65 mm (autotomized portion missing); complete inscriptional chevrons 13.

## Etymology

The species name is derived from the Greek words for 'long' (*tany*) and 'body' (*soma*) to call attention to the relatively elongate appearance of the species due, in part, to its short limbs.

## Distribution

The species has been found only on the Sahamalaza Peninsula.

**Fig. 10.** *Amphiglossus stylus* n. sp. Holotype: MRSN R1732; SVL = 65 mm.

### *Habitats and habits*

The holotype was captured in a pitfall trap overnight after heavy rainfall, suggesting that the species is likely to be crepuscular or nocturnal. A paratype (MRSN R1865) was captured inactive during the day under rotten wood in a cacao plantation. The Berara Forest where the holotype was collected is a portion of the much wider Anabohazo Forest, on the Sahamalaza Peninsula. The peninsula is characterized by a series of hills of *c.* 300–350 with some seasonal streams which usually dry up in September (Anonymous, 1999). The climate is of the hot sub-humid type, receiving a mean yearly rainfall of 1747 mm; the temperature is *c.* 26–27 °C throughout the year (Projet ZICOMA, 1999). Although Sahamalaza is included in the biogeographic domain of the west, its vegetational aspects (dominated by a dry forest belonging to the *Dalbergia*, *Commiphora* and *Hildegardia* series) and climate are in some senses transitional between those of the Sambirano humid area and those of the dry west area (Humbert, 1955; Anonymous, 1999; Project ZICOMA, 1999).

### *Comparison with similar species*

*Amphiglossus tanysoma* is most similar to *A. alluaudi* and *A. elongatus* in having limbs pentadactyl and presacral vertebrae $\geq 52$ (*A. alluaudi* have 49–52). However, *A. tanysoma* differs from *A. alluaudi* in its larger size (75–103 mm *vs* 58–85 mm), higher number of longitudinal scale rows at mid-body (26–28, $n = 3$ *vs* 24, $n = 6$), higher number of ventral scales (107–111, $n = 3$ *vs* 90–104, $n = 6$), relatively wider body (ventral body width at level of front limb for smallest *A. tanysoma* with SVL of 75 mm = 5.8 mm and for holotype of *A. alluaudi* (MNHN 1993.647) with SVL of 78 mm = 4.4 mm), slightly more reduced phalangeal formula for both the manus and pes (2.2.3.3.2/2.3.3.4.3 *vs* 2.3.3.3.2/2.3.4.4.3) and pigment concentrated through the centres of the body scales instead of at the edges, albeit diffusely (holotype). Further to the size difference between the two species, the two smallest *A. tanysoma*, a male with a SVL of 75 mm and a female with a SVL of 81 mm, are both immature (small gonads and efferent ducts) whereas the male holotype of *A. alluaudi* has a SVL of 78 mm and is mature (large testes and efferent ducts) (Brygoo, 1981*a* for data on scale counts in *A. alluaudi*). This difference suggests that the larger *A. tanysoma* matures at a larger size than *A. alluaudi*.

*Amphiglossus tanysoma* differs from *A. elongatus* in its relatively longer front (6–9% *vs* 4% of SVL) and rear (11–15% *vs* 5–6%) limbs and less reduced phalangeal formula for both the manus and pes (2.2.3.3.2/2.3.3.4.3 *vs* 2.2.2.2.2/2.2.3.3.3) (Brygoo, 1981*a* for data on limb and body length in *A. elongatus*).

### *Comment*

In a recent paper by Andreone, Vences & Randrianirina (2001) on the herpetofauna of Sahamalaza, *Amphiglossus tanysoma* was reported in the text as '*A.* n. sp.'. However, in the appendix, it was listed through an oversight as *Androngo elongatus*.

## *Amphiglossus stylus* n. sp.

(Figs 10 & 11)

### *Holotype*

MRSN R1732, immature (or reproductively quiescent) male, fixed in 4% formalin, preserved in 70% ethanol, collected at Masoala Peninsula, Campsite 5 (Menamalona), Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 15°22.87′S, 49°59.27′E, 780 m, on 16 December 1999 by F. Andreone and J. E. Randrianirina.

### *Diagnosis*

Differs from all other *Amphiglossus* (see Generic Concepts and Diagnoses section below), and indeed all other non-lygosomine skinks, in having the front and rear limbs reduced to a minute, clawless nub and style, respectively. It is also the only skink to have in combination: the absence an external ear opening and both the front and rear limbs reduced to small clawless stubs.

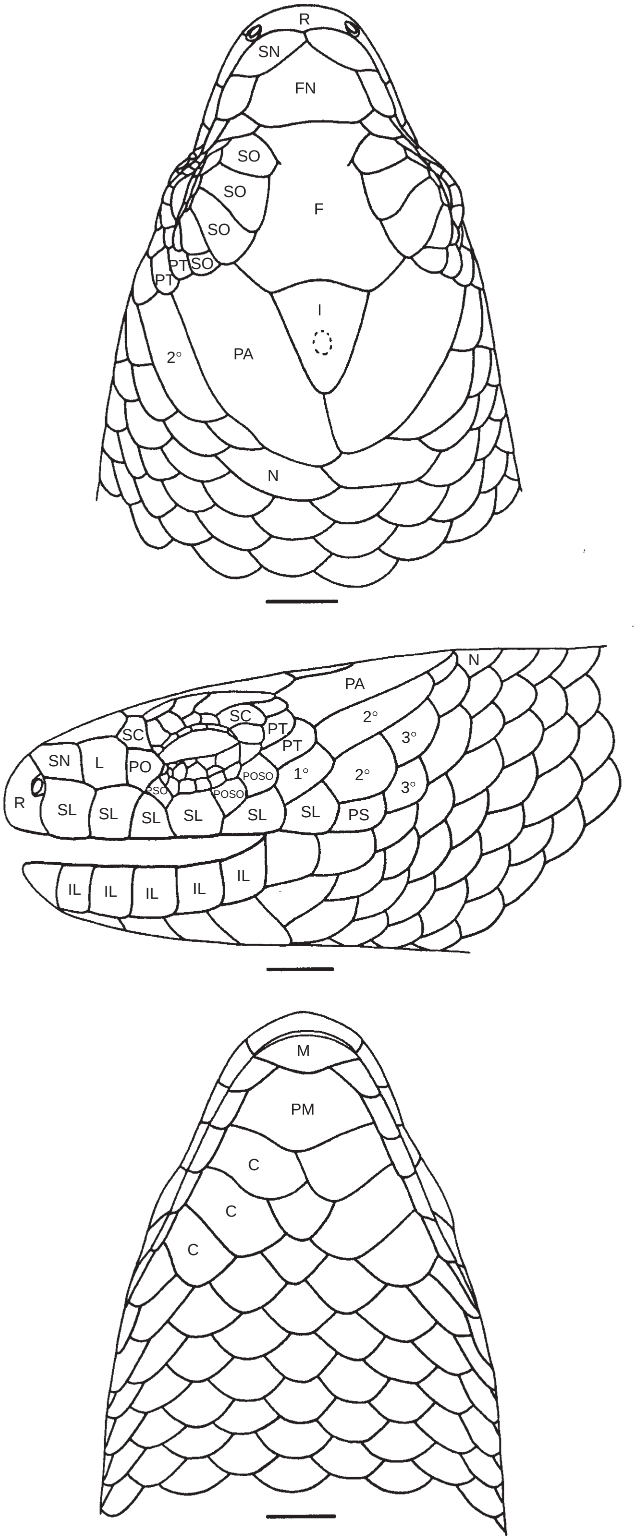

**Fig. 11.** Head scales of *Amphiglossus stylus* n. sp. (holotype: MRSN R1732) in dorsal, lateral and ventral view. Scale bar = 1 mm.

### *Description*

*External morphology.* In general appearance, a thin dark brown skink of moderate size (SVL = 65 mm) and both sets of limbs reduced to small stubs.

Snout bluntly rounded in both dorsal and lateral view; rostral confined to anterior part of snout; supranasals in contact; frontonasal wider than long; frontal constricted by first supraocular, that is, frontal hourglass-shaped (Greer & Shea, 2000); supraoculars four, first constricting frontal, anterior three contacting frontal, fourth small; frontoparietals absent; interparietal well separated from supraoculars; parietal eyespot just posterior of centre of interparietal; parietals meet behind interparietal; nuchals a single pair.

Nasal a small, anteriorly open crescent scarcely larger than nostril and lying just inside posterior edge of rostral; nostril formed by rostral anteriorly and nasal dorsally, posteriorly and ventrally; postnasal absent; loreal single; preocular single; presubocular single; supraciliaries six, in continuous row, first in broad contact with frontal, first three contacting first supraocular, last very large and projecting medially into supraocular series (thereby greatly reducing fourth supraocular in size); upper palpebrals small except for last which is large and projecting medially posterior to last supraciliary; upper palpebrals contact supraciliaries firmly anteriorly and posteriorly, with palpebral cleft only slightly open along its central part; pretemporals two, both contacting parietal; postsuboculars two, both contacting penultimate supralabial, upper contacting lower pretemporal; lower eyelid scaly and movable; primary temporal single; secondary temporals two, upper long, contacting ventral pretemporal anteriorly, overlapping lower secondary temporal ventrally and separated from anterior nuchal by small scale on left side but contacting anterior nuchal on right side; tertiary temporals bordering lower secondary temporal two; supralabials six, fourth subocular; postsupralabial single; external ear opening absent, with no external indication of its former position.

Mental wider than long; postmental single, contacting two infralabials on each side; infralabials six; three pairs of large chin scales, members of first pair in contact, members of second pair separated by one scale row, and members of third pair separated by three scale rows; chin scales flush with infralabials, i.e. genials do not encroach between chin scales and infralabials.

Body scales cycloid, perfectly smooth with glossy finish, each dorsal scale with a crescentic series of microscopic pits just anterior to the posterior edge of scale; longitudinal scale rows at mid-body 20; paravertebrals 91; ventrals 93; inner preanals overlap outer; scales in mid-ventral caudal row similar in size to scales in adjacent rows.

Front limb represented by a minute, clawless nub and rear limb reduced to small, clawless style.

SVL 65 mm; tail almost complete, *c.* 100 mm.

*Soft anatomy.* Inguinal fat bodies present. Testes regressed and epididymides thin, suggesting that specimen is immature or, possibly, in a reproductively quiescent state.

*Skeletal features.* Premaxillary teeth difficult to distinguish but probably eight; crowns of teeth bluntly rounded; hyoid elements resolvable on radiographs

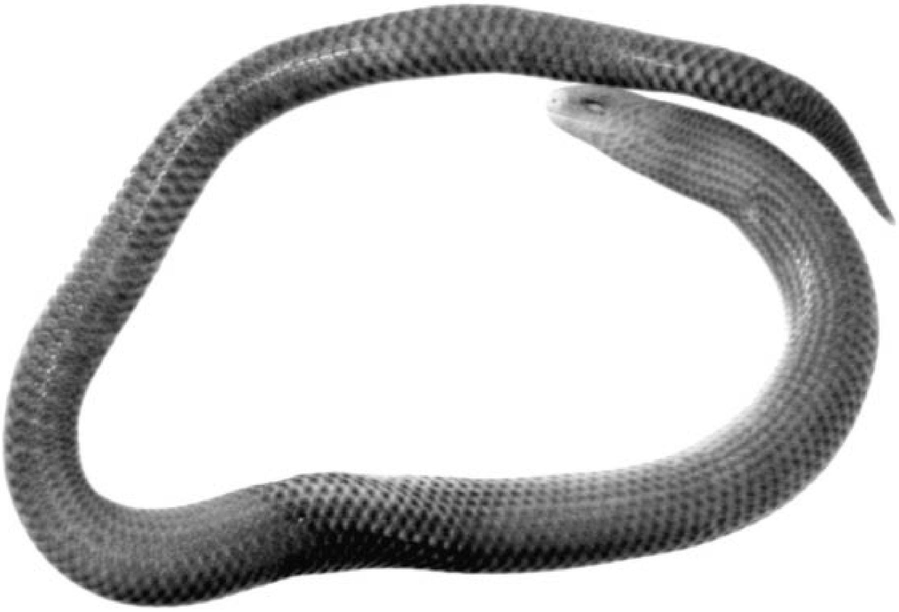

**Fig. 12.** *Paracontias hafa* n. sp. Holotype: MRSN R1825; SVL = 69 mm.

include ceratohyal and ceratobranchials I and II; pectoral girdle consists of clavicle, interclavicle and scapulocoracoid; humerus cannot be resolved on radiograph; sternum present, with two attached ribs (from presacral vertebrae 9–10); mesosternum cannot be conclusively resolved on radiograph, but seems to be absent; complete inscriptional chevrons 21, each acutely angled anteriorly; pelvic girdle's two halves separated on midline, each half strongly tripartite consisting of ilium, pubis and ischium; rear limb represented by completely internal femoral fragment; presacral vertebrae 52; cervical vertebrae eight; sacral vertebrae two, diapophyses fused laterally; caudal vertebrae 66; transverse processes of caudal vertebrae project anterolaterally at an angle of *c.* 55–60°; caudal autotomy plane position relative to transverse process unresolved on radiographs; free ribs begin on fourth presacral vertebra; all ribs smooth-sided, i.e. without accessory processes.

*Colour in life.* Dorsum reddish-brownish, with small, indistinct dark spots, in certain light almost iridescent. Eyes and eyelids darker than rest of body. Venter much paler than dorsum, almost translucent, the internal organs being evident.

*Colour in preservative.* Ground colour medium brown, darkest above, palest below; pigment on body slightly concentrated at base of scales. Tongue pale grey anteriorly, becoming gradually paler posteriorly. Parietal peritoneum pale.

### *Etymology*

The species name is derived from the Greek word for 'column' or 'pillar' (*stylis*) and calls attention to the species minute, clawless limbs.

### *Distribution*

*Amphiglossus stylis* is known only from Menamalona, Masoala Peninsula, in a still fairly intact rainforest close to the Parc National de Masoala. It remains to be seen if the species is a Masoala endemic or if it is more widely distributed along the eastern rainforest belt.

### *Habitat and habits*

The single specimen was captured in a pitfall trap in a rather dense rainforest not far from the Menamalona Stream. The forest is apparently not much altered, although it is not too far from the path leading to the Ilampy village. The specimen was trapped over night, suggesting that the species is probably nocturnal. It is also probably fossorial to judge from its degree of limb reduction.

### *Comparison with similar species*

In having 20 longitudinal scale rows at mid-body, *Amphiglossus stylus* is similar to *A. decaryi* (20), *A. minutus* (22–20) and *A. nanus* (20), but it differs from these three species in being much longer with maximum SVL = 65 mm *vs* 44.5, 39 and 33.5 mm, respectively; in lacking an external ear opening, and in having the limbs reduced to small clawless remnants instead of with digits 5/5 (4/5 in some *A. nanus* specimens) and clawed.

In having > 50 presacral vertebrae (52), *Amphiglossus stylus* is similar to *A. alluaudi* (49–52), *A. tanysoma* (52), *A. elongatus* (52–53 in the one MRSN specimen and the type, respectively) and *A. crenni* (54–57), but it differs from these four species in lacking an external ear opening and in having fewer longitudinal scale rows at mid-body with 20 *vs* 24, 28, 28 and 26–28, respectively, and the limbs reduced to small clawless remnants instead of digits 5/5 and all clawed in *A. alluaudi*, *A. tanysoma* and *A. elongatus* and digits 3/4 to 2/3 and all clawed in *A. crenni*.

### *Comments*

This species is interesting for its combination of relatively unmodified head scales and a high degree of ear loss and limb reduction. The species' head scale numbers and configuration are comparable to species of *Amphiglossus* (see below) with an external ear opening and well developed pentadactyl limbs, and yet it lacks, uniquely for *Amphiglossus*, all trace of an external ear opening and has limbs that are reduced to short clawless nubbins (front) or styles (rear) that are almost certainly ineffectual in locomotion. Hence, if this species can be taken as a guide to how other limb-reduced Malagasy skinks may have evolved from *Amphiglossus*, it suggests that the loss of the external ear opening could have preceded the loss of limbs, and that both ear reduction and substantial limb reduction could have occurred with relatively little modification of the head scales. In other words, evolutionarily, changes in the head scales have been effectively decoupled from changes in the ear and limbs in this species.

## ***Paracontias hafa* n. sp.**

(Figs 12 & 13)

### *Holotype*

MRSN R1825, adult female with poor fixation over posterior third of body, fixed in 4% formalin and preserved in 70% ethanol, collected at Anjanaharibe-Sud Massif, Analabe Valley, Campsite W1, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46′S, 49°27′E, 1000–1100 m, on 25 January 1996, by F. Andreone, H. Randriamahazo, and J. E. Randrianirina.

### *Diagnosis*

Differs from all other species of *Paracontias* (as conceived by Brygoo, 1980*b*) in the following combination of characters: frontal hourglass-shaped, i.e. first supraocular constricts frontal (*vs* bell-shaped); supraoculars four (*vs* three); nasal and nostril well within extensive rostral (*vs* between rostral and first supralabial), and supralabials five (*vs* four).

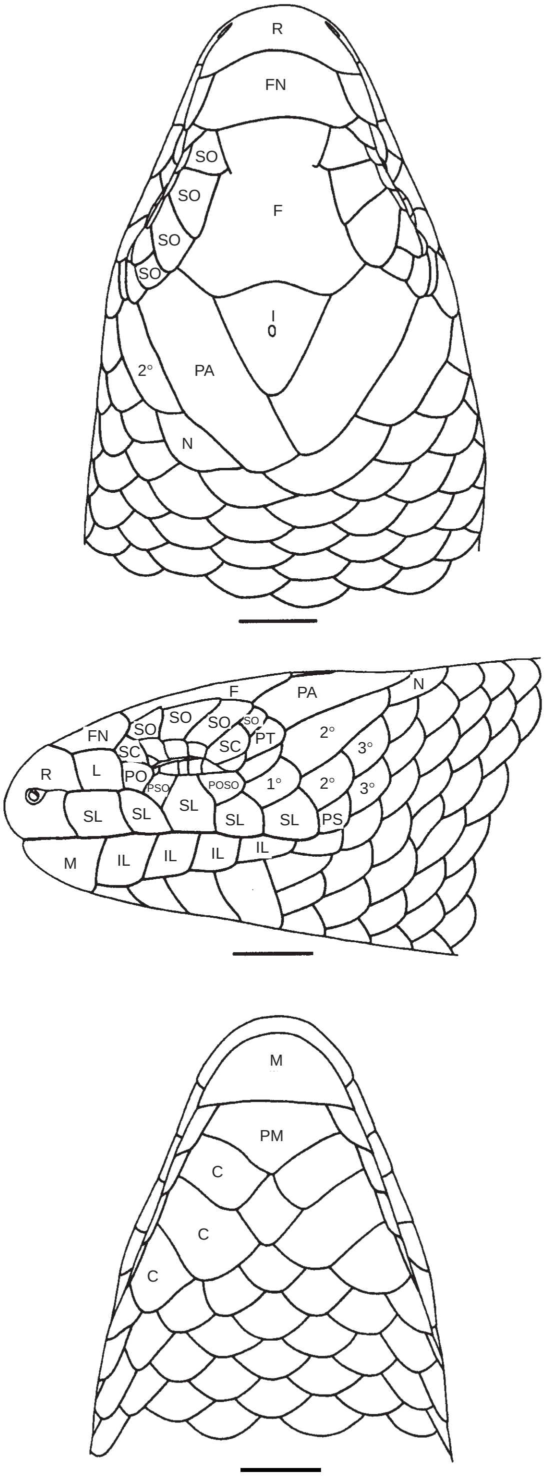

**Fig. 13.** Head scales of *Paracontias hafa* n. sp. (holotype: MRSN R1825) in dorsal, lateral and ventral view. Only the most anterior and most posterior supraciliaries (SC) and only the most ventral postsuboculars (POSO) are labelled. Scale bar = 1 mm.

### *Description*

*Morphology*. In general appearance, a small to medium-sized (SVL = 69 mm), slender, limbless skink of medium brown colour.

Snout bluntly rounded in both dorsal and lateral aspect; rostral surrounds nasal but without fusing posteriorly to it, projecting broadly onto snout with that part dorsal to nasal suture extending further posteriorly than that part ventral to nasal suture; dorsomedial edge of rostral posteriorly concave; frontonasal appreciably wider than long; prefrontals absent; frontal hourglass-shaped (Greer & Shea, 2000); supraoculars four, first constricting frontal, anterior three contact frontal, last small; frontoparietals absent; interparietal moderate in size but separated from supraoculars; parietal eye quite obvious just posterior of centre of interparietal; parietals meet posterior to interparietal; nuchals 0/1.

Nasal small, widest posteriorly, surrounded entirely by rostral; nostril entirely within nasal; postnasal absent; loreal single; preocular single; presubocular single; postsuboculars two, only lower contacting penultimate supralabial; lower eyelid movable, consisting of three large, semi-opaque scales, i.e. either lacking distinct small lower palpebrals on these scales having become quite deep; supraciliaries five, first well separated from frontal, first two contact first supraocular, last large, projecting dorsomedially behind third supraocular; upper palpebrals mostly small, under supraocular shelf and apparently tightly abutting supraciliaries, i.e. no palpebral cleft, last upper palpebral large, projecting dorsomedially posteriorly to last (also large and dorsomedially projecting) supraciliary; pretemporal single, contacting parietal; primary temporal single; secondary temporals two, upper long and narrow, contacting pretemporal anteriorly and overlapping lower secondary temporal ventrally; tertiary temporals bordering lower secondary temporal two; scales between upper secondary temporal and paravertebral abutting parietal 1/0; supralabials five, third subocular and contacting eyelid scales; postsupralabial single; external ear opening absent, with no indication of its former position.

Mental wider than long; postmental single, contacting first infralabial only; infralabials four; three pairs of large chin scales, members of first pair in contact only at very anteromedial corners, members of second pair separated by one scale row, and members of third pair separated by three scale rows; large chin scales contact infralabials, i.e. genials do not encroach between chin scales and infralabials; rostral and mental scales slightly thickened and with slightly milky colour.

Body scales cycloid, glossy, smooth, each mid-dorsal scale at mid-body with a few very minute pits just anterior to scale's free edge; longitudinal scale rows at mid-body 20; paravertebrals 100; ventrals 102; inner preanals overlap outer; scales in mid-ventral caudal row similar in size to scales in adjacent rows.

SVL 69 mm; tail length 63 mm of which 8 mm is regenerated.

*Soft anatomy*. Inguinal fat body present.

*Skeletal features*. Jugal's postorbital process well developed; epipterygoid present; teeth bluntly peg-like; hyoid elements resolvable on radiographs include glossohyal and ceratobranchial II; pectoral girdle consists of clavicle, interclavicle, and scapulocoracoid; no evidence of humerus on radiograph; sternum present, with probably only one attached rib (from presacral vertebra 9); mesosternum not resolvable on radiograph, but assuming it to be absent, complete inscriptional chevrons 19; pelvic girdle halves separated medially, each consisting of tri-partite element representing ilium, ischium and pubis; no evidence of femur on radiograph; presacral vertebrae 53; first free rib on fourth presacral; cervical vertebrae eight; sacral diapophyses fused distally; caudal vertebrae's transverse processes project anterolaterally at an angle of *c.* 55–60°; caudal autotomy planes seem to be just anterior to transverse processes.

*Colour in life*. Dorsal ground colour almost reddish-copper, with some small darker spots in the centre of each scale; anterior part of body paler than posterior part. Venter paler than dorsum and somewhat translucent.

*Colour in preservative*. Ground colour medium brown with darker brown concentrated at centre of base of each scale, overall colour darkest dorsally and becoming slightly paler ventrally, hence longitudinal rows of dark spots in centres of scales becoming more obvious ventrally; tail similar in colour to that of body. Parietal peritoneum pale.

## *Etymology*

The specific name '*hafa*' is a Malagasy word meaning 'strange', 'different', or 'other' and is used here as a noun in apposition, stressing that this species is strange and different from the other currently known *Paracontias*. The phonetic rendition is: *har*far (accented syllables italicized).

## *Distribution*

The species is known only from Anjanaharibe-Sud Massif, but on zoogeographic grounds it could also possibly occur at Marojejy.

## *Habitat and habits*

The habitats in Analabe Valley are a patchwork of pristine and altered forest, with most of the unaltered forest occurring on the ridges and steepest slopes. In the degraded patches, the original vegetation has been replaced by ferns and grasses. During the period that the valley was surveyed, the weather was cloudy with almost daily rainfall. The minimum air temperature the night of capture was 18 °C. Mean maximum daily air temperatures during the survey period ranged from 20 to 22 °C. The single specimen was found during digging while preparing the campsite. It is therefore likely that, similar to other *Paracontias* species, it is a semi-fossorial

**Fig. 14.** *Paracontias manify* n. sp. Holotype: MRSN R1887; SVL = 67 mm.

skink, living in the forest litter. It is probably active at night.

### Comparison with similar species

*Paracontias hafa* is similar to three other species in the genus in having a hourglass-shaped frontal: *P. hildebrandti*, *P. holmelas* and *P. milloti. Paracontias hafa* differs from *P. hildebrandti* and *P. holomelas* in having the anterior chin scales in contact (albeit only slightly) instead of usually separated (narrowly in contact in one of eight *P. hildebrandti*), and cervical vertebrae eight instead of seven. It differs further from *P. hildebrandti* in having supralabials five instead of four. It differs further from *P. holomelas* in having longitudinal scale rows at mid-body 20 instead of 30 (Brygoo, 1980*b*). It differs from *P. milloti* in having nuchals (total) 2 instead of $\geq 2$ (3), the nasal entirely within the rostral instead of between the rostral and first supralabial, the loreal distinct instead of fused to frontonasal, and presacral vertebrae 53 instead of 47 (Brygoo, 1980*b*).

## *Paracontias manify* n. sp.

(Figs 14 & 15)

### Holotype

MRSN R1887, immature female, fixed in 4% formalin and preserved in 70% ethanol, collected at Antsahamanara, Manarikoba Forest, RNI de Tsaratanana, Marovato Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°02.55′S, 48°46.79′E, about 1000 m, on 7 February 2001, by F. Andreone, F. Mattioli, J. E. Randrianirina and M. Vences.

### Diagnosis

A species of the endemic Malagasy genus *Paracontias* as conceived by Brygoo (1980*b*) but differing from the other species in the genus in the following combination of characters: frontal bell-shaped (*vs* hourglass-shaped) and supraoculars four (*vs* three).

### Description

*External morphology.* In general appearance, a small to medium-sized (SVL = 67 mm), slender, limbless skink of medium brown colour.

Snout bluntly rounded in both dorsal and lateral aspect; rostral surrounds nasal but without fusing posterior to it, projecting broadly onto snout with that part dorsal to postnasal suture extending further posteriorly than that part ventral to postnasal suture; dorsomedial edge of rostral straight; supranasals absent; frontonasal appreciably wider than long; prefrontals absent; frontal bell-shaped (Greer & Shea, 2000); supraoculars four, anterior three contacting frontal; frontoparietals absent; interparietal moderate in size but separated from supraoculars; parietal eye not evident; parietals meet posterior to interparietal; nuchals 1/1.

Nasal small, crescentic, surrounded entirely by rostral; nostril surrounded entirely by small nasal which is widest posteriorly; postnasal absent; loreal single; preocular single; presubocular single; postsuboculars two, both contacting penultimate supralabial; lower eyelid movable, consisting of two or three large, semi-opaque scales, i.e. either lacking distinct small lower palpebrals or these scales having become quite deep; supraciliaries five, first well separated from frontal, first two contact first supraocular, last projecting dorsomedially behind third supraocular; upper palpebrals mostly small, under supraocular shelf and apparently tightly abutting supraciliaries, i.e. no palpebral cleft, last upper palpebral large, projecting dorsomedially posteriorly to last (also large and dorsomedially projecting) supraciliary; pretemporal single, not contacting parietal (due to ventrolateral extension of fourth supraocular); primary temporal single; secondary temporals two, upper contacts fourth supraocular anteriorly and overlaps lower secondary temporal ventrally; scales separating upper secondary temporal from nuchal 1/1; tertiary temporals bordering lower secondary temporal two; supralabials five, third subocular and contacting eyelid scales; postsupralabial single; external ear opening totally absent, no indication of its former position.

Mental wider than long; postmental single, contacting first infralabial only; infralabials four; three pairs of large chin scales, members of first pair separated by one scale row, members of second pair separated by one scale row, and members of third pair divided and

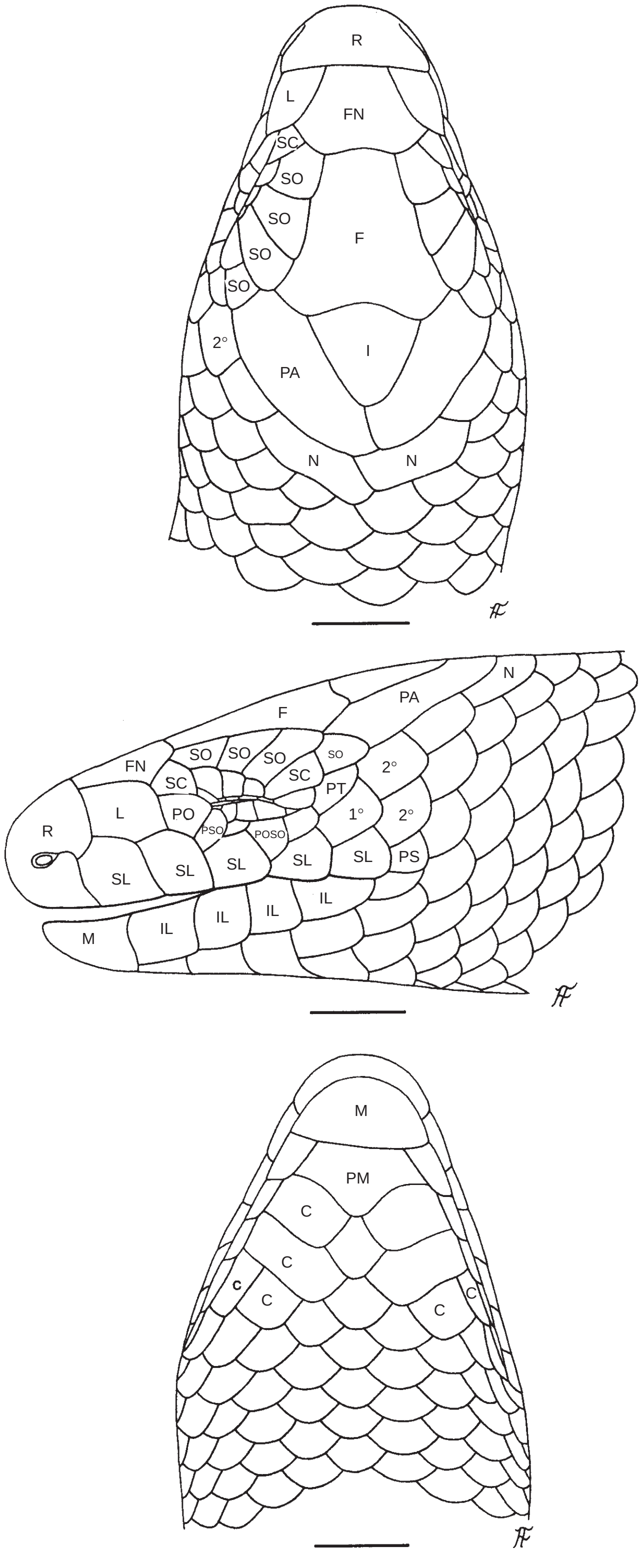

**Fig. 15.** Head scales of *Paracontias manify* n. sp. (holotype: MRSN R1887) in dorsal, lateral and ventral view. Only the most anterior and most posterior supraciliaries are labelled. Scale bar = 1 mm.

separated by three scale rows; large chin scales contact infralabials, i.e. genials do not encroach between chin scales and infralabials; rostral and mental scales slightly thickened and with slightly milky colour, this effect extending posteriorly with diminishing intensity along supralabials and infralabials.

Body scales cycloid, glossy, smooth, each mid-dorsal scale at mid-body with a few very minute pits just anterior to scale's free edge; longitudinal scale rows at mid-body 22; paravertebrals 127; ventrals 125; inner preanals overlap outer; scales in mid-ventral caudal row similar in size to scales in adjacent rows.

SVL 67 mm; tail length 47 mm of which *c.* 6 mm is regenerated.

*Soft anatomy.* Inguinal fat body present.

*Skeletal features.* Premaxillary teeth seven; crowns of teeth bluntly rounded; jugal's postorbital process well developed; epipterygoid present; hyoid elements resolvable on radiographs include glossohyal and ceratobranchials I and II; pectoral girdle consists of clavicle and scapulocoracoid; interclavicle cannot be conclusively resolved on radiographs; no internal trace of front limbs; sternum present, with attached ribs from eighth and possibly ninth presacral vertebrae; mesosternum cannot be resolved on radiographs; complete inscription chevrons 18 (if one sternal rib attachment) or 19 (if two sternal rib attachments); pelvic girdle halves widely separated, each half consisting of a tri-partite element representing ilium, ischium and pubis; no internal trace of rear limbs; presacral vertebrae 59; first free rib on third presacral; all ribs smooth-sided, i.e. without trace of accessory processes; cervical vertebrae seven; sacral vertebrae two, the diapophyses' distal ends separated; postsacral vertebrae 38 +; caudal vertebrae's transverse processes project anterolaterally at an angle of *c.* 55–60°.

*Colour in life.* The general dorsal colour of *P. manify* is brownish-reddish, shading to copper, with a darker area visible in middle of each scale, giving impression of a reticulated pattern on back and flanks. Head and posterior part of the body darker than rest of dorsum. Eyes dark. Venter a little bit lighter than the back, and translucent. The species is also iridescent.

*Colour in preservative.* Ground colour medium brown dorsally (darkest on head and distal part of tail) becoming paler ventrally with darker pigment concentrated at centre of each scale base creating general pattern of indistinct longitudinal rows of dark spots which become most distinct on pale venter. Parietal peritoneum pale.

## *Etymology*

The name 'manify' is a Malagasy word, which means 'thin' or 'slim', in reference to the general aspect of this species. It is treated as an indeclinable noun. The species name is pronounced: mah-*nee*-fee.

**Fig. 16.** *Paracontias tsararano* n. sp. Holotype: MRSN R1787; SVL = 66 mm.

### *Distribution*

To date, the species is known only from the type locality in the Tsaratanana Massif.

### *Habitat and habits*

The single specimen was collected in a fairly typical mid-altitude rainforest that at least locally remains relatively undisturbed compared to other areas in the Tsaratanana Massif (Nicoll & Langrand, 1989).

### *Comparison with similar species*

*Paracontias manify* is similar to three other species in the genus in having a bell-shaped frontal and the members of the anterior pair of chin scales separated: *P. brocchi*, *P. rothschildi* and *P. tsararano*. However, it differs from these three species in having supraoculars four instead of three. It differs further from *P. brocchi* and *P. rothschildi* in having the small nasal scale entirely surrounded by the rostral instead of between the rostral and first supralabial, and postsuboculars two instead of one. It differs further from *P. brocchi* in having only 22 longitudinal scale rows at mid-body instead of 26 (Brygoo, 1980*b*); presacral vertebrae 59 instead of 63–64 (Brygoo, 1980*b*), and cervical vertebrae seven instead of eight. It differs further from *P. rothschildi* in having the total number of nuchals 2 instead of ≥ 2 (4), and presacral vertebrae 59 instead of 46 (Brygoo, 1980*b*). It differs further from *P. tsararano* in having pretemporal separated from parietal instead of in contact, and third pair of chin scales divided instead of entire.

## ***Paracontias tsararano*** **n. sp.**

(Figs 16 & 17)

### *Holotype*

MRSNR1787, adult female, fixed in 4% formalin, preserved in 70% ethanol, collected at Tsararano Forest, Campsite 1 (Antsarahan'ny Tsararano), 14°54.4′S, 49°41.2′E, 710 m, on 30 November 1996, by F. Andreone and J. E. Randrianirina.

### *Diagnosis*

A species of the endemic Malagasy genus *Paracontias* as conceived by Brygoo (1980*b*) but differing from the other species in the genus in the following combination of characters: frontal bell-shaped (*vs* hourglass-shaped); supraoculars three (*vs* four); nuchals 1/1 (*vs* ≥ 1/1); nasal enclosed posteriorly by rostral (*vs* between rostral and first supralabial), and members of anterior pair of chin scales separated (*vs* in contact).

### *Description*

*External morphology*. In general appearance, a small to medium-sized (SVL = 66 mm), slender, limbless skink of medium brown colour.

Snout bluntly rounded in both dorsal and lateral aspect; rostral surrounding nasal but without fusing posterior to it, projecting broadly onto snout with that part dorsal to postnasal suture extending further posteriorly than that part ventral to postnasal suture; dorsomedial edge of rostral posteriorly concave; supranasals absent; frontonasal appreciably wider than long; prefrontals absent; frontal bell-shaped (Greer & Shea, 2000); supraoculars three, first two contacting frontal; frontoparietals absent; interparietal moderate in size but separated from supraoculars; parietal eye not evident, although small pale area just posterior of centre of interparietal may represent its position; parietals meet posterior to interparietal; nuchals 1/1.

Nasal small, crescentic, surrounded entirely by rostral; nostril bordered by small nasal except possibly for small anterodorsal section bordered by rostral; postnasal absent; loreal single (posteroventral corner hived off on left side, probably anomalously); preocular single; presubocular single; postsuboculars two, both contacting penultimate supralabial; lower eyelid movable, consisting of two or three large, semi-opaque scales, i.e. either lacking distinct small lower palpebrals or these scales having become quite deep; supraciliaries five, first well separated from frontal, first three contact

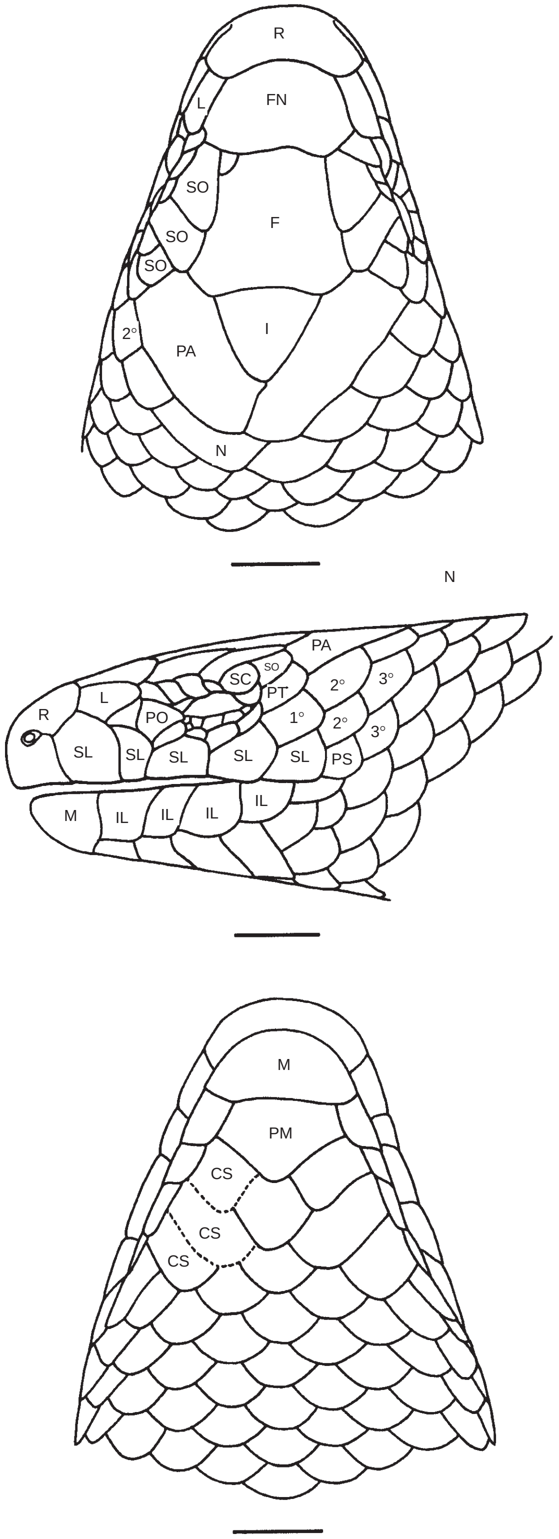

**Fig. 17.** Head scales of *Paracontias tsararano* n. sp. (holotype: MRSN R1787) in dorsal, lateral and ventral view. Only the most posterior supraciliary (SC) is labelled. Scale bar = 1 mm.

first supraocular, last projecting dorsomedially behind second supraocular; upper palpebrals mostly small, under supraocular shelf and apparently tightly abutting supraciliaries, i.e. no palpebral cleft, last upper palpebral large, projecting dorsomedially posteriorly to last (also large and dorsomedially projecting) supraciliary; pretemporal single, contacting parietal; primary temporal single; secondary temporals two, upper contacts posterior but not anterior pretemporal anteriorly and overlaps lower secondary temporal ventrally; scales separating upper secondary temporal from nuchal 1/2; tertiary temporals bordering lower secondary temporal two; supralabials five, third subocular and contacting eyelid scales; postsupralabial single; external ear opening totally absent, no indication of its former position.

Mental wider than long; postmental single, contacting first infralabial only; infralabials four; three pairs of large chin scales, members of first pair separated by one scale row, members of second pair separated by one scale row, and members of third pair separated by three scale rows; rostral and mental scales slightly thickened and with slightly milky colour, this effect extending posteriorly with diminishing intensity along supralabials and infralabials.

Body scales cycloid, glossy, smooth, each mid-dorsal scale at mid-body with a few very minute pits just anterior to scale's free edge; longitudinal scale rows at mid-body 21; paravertebrals 109; ventrals 114; inner preanals overlap outer; scales in mid-ventral caudal row similar in size to scales in adjacent rows. SVL 66 mm; tail length 55.5 mm of which 4.5 mm is regenerated.

*Skeletal features*. Frontals each appear to have a long and deep process descending into orbital area; epipterygoid present; jugal's postorbital process well developed; pectoral girdle consists of clavicle and scapulocoracoid; interclavicle cannot be conclusively resolved on radiographs but probably present; no internal trace of front limbs; sternum present, with attached ribs from eighth and ninth presacral vertebrae; mesosternum probably absent; complete inscription chevrons 21, all anteriorly V-shaped but becoming more transversely orientated posteriorly; pelvic girdle halves widely separated, each half consisting of a tri-partite element representing ilium, ischium and pubis; no internal trace of rear limbs; presacral vertebrae 57; first free rib on fourth presacral; all ribs smooth-sided, i.e. without trace of accessory processes; cervical vertebrae seven; sacral vertebrae two, the diapophyses' distal ends fused, posterior diapophysis larger than anterior; postsacral vertebrae 35 +; caudal vertebrae's transverse processes project anterolaterally at an angle of *c*. 55°; autotomy plane of caudal vertebrae appears to be just anterior to transverse process.

*Colour in life*. General ground colour of dorsum almost reddish-copper, with a smaller darker area in centre of each scale, giving the impression of an ill-defined 'striped' pattern on back. Tail slightly darker than body. Venter paler than dorsum and somewhat translucent.

*Colour in preservative*. Ground colour on head and tail dark brown and on body medium brown dorsally but becoming paler ventrally; on body darker brown colour concentrated in central base of each scale, forming general pattern of indistinct longitudinal rows

**Fig. 18.** *Pseudoacontias menamainty* n. sp. Holotype: MRSN R1826; SVL = 224 mm; total length = 259 mm.

of dark spots, which with paling of ground colour on flanks, become more obvious ventrally. Tongue pale throughout. Parietal peritoneum pale.

### *Etymology*

The specific name '*tsararano*' is a compound Malagasy word meaning 'good water' and is used here as a noun in apposition ('the one from the good water'). Tsararano is also the name of the river and forest where the holotype was collected. The phonetic rendition is: sara-*ra*rno (accented syllables italicized).

### *Distribution*

The species is known to date only from the Tsararano Forest. Considering the biogeographical affinities of the areas of north-east Madagascar south of Marojejy (see Andreone, Randrianirina *et al.*, 2000), the species could also occur either northwards, such as in the Besariaka Forest on the Anjanaharibe-Sud Massif or southwards, as on the Masoala Peninsula.

### *Habitat and habits*

The single known specimen was captured in a pitfall trap overnight, suggesting that it is probably nocturnal. For consideration on the status of the Tsararano forest, see this section in the description of *Amphiglossus spilostichus* and Andreone, Randrianirina *et al.* (2000).

### *Comparison with similar species*

*Paracontias tsararano* is similar to three other species in the genus in having a bell-shaped frontal and the members of the anterior pair of chin scales separated: *P. brocchi*, *P. manify* and *P. rothschildi. Paracontias tsararano* differs from *P. brocchi* and *P. rothschildi* in having the nasal scale entirely surrounded by the rostral instead of between rostral and first supralabial. It differs further from *P. brocchi* in having longitudinal scale rows at mid-body 21 instead of 26, presacral vertebrae 57 instead of 63–64 (Brygoo, 1980*b*), and cervical vertebrae seven instead of eight. It differs further from *P. rothschildi* in having total nuchals 2 instead of $\geq 2$ (4), and presacral vertebrae 57 instead of 46 (Brygoo,

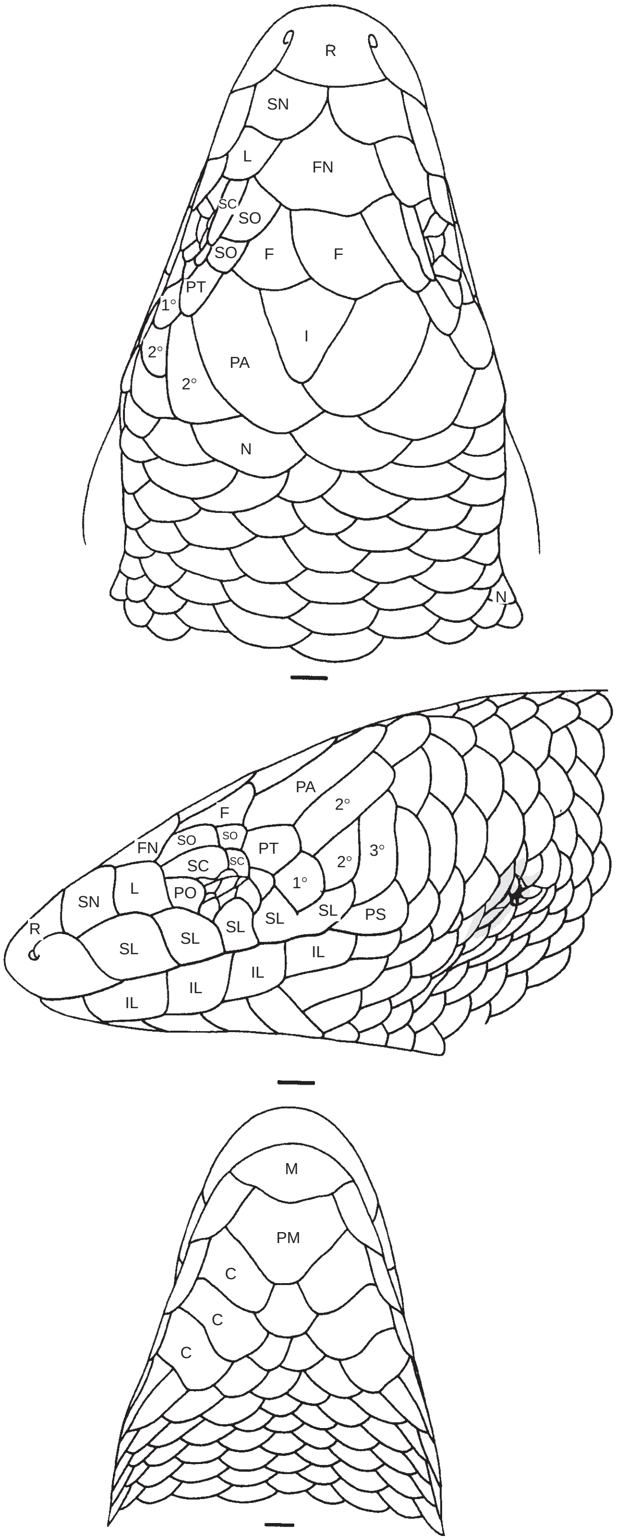

**Fig. 19.** Head scales of *Pseudoacontias menamainty* n. sp. (holotype: MRSN R1826) in dorsal, lateral and ventral view. Scale bar = 1 mm.

1980*b*). It differs from *P. manify* in having supraoculars three instead of four, pretemporal in contact with parietals instead of separated, and third pair of chin scales entire instead of divided.

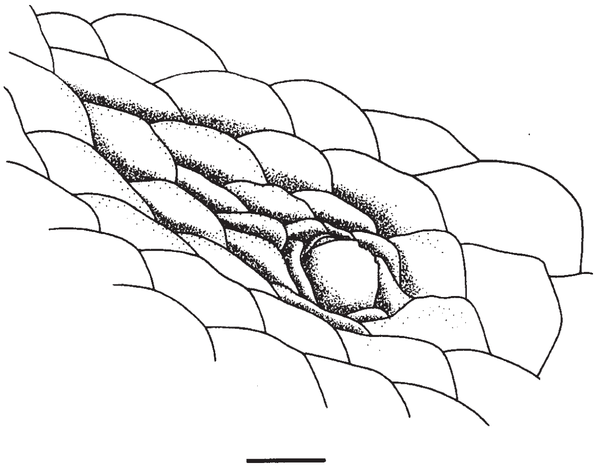

**Fig. 20.** Detail of front left limb rudiment of *Pseudoacontias menamainty* n. sp. (holotype: MRSN R1826). Scale bar = 1 mm.

### *Pseudoacontias menamainty* n. sp.

(Figs 18–20)

#### *Holotype*

MRSN R1826, adult female, fixed in 100% ethanol and preserved in 70% ethanol, collected at Berara Forest, Sahamalaza Peninsula, Analalava Fivondronana, Mahajanga Faritany (Majunga Province), 14°18.55′S, 47°54.92′E, altitude *c.* 170 m, on 17 February 2000, by F. Andreone and J. E. Randrianirina.

#### *Diagnosis*

A species of *Pseudoacontias* (see Generic concepts and diagnoses, below) distinguished from the two other species in the genus, *P. angelorum* Nussbaum & Raxworthy, 1995 and *P. madagascariensis* Barboza du Bocage, 1889 (holotype and only known specimen destroyed), in the following combination of characters: frontal divided obliquely (possibly anomalous); nostril well into rostral scale (*vs* close to posterior edge); loreal slightly deeper than long (much longer than deep); supralabials five (six); infralabials four (five and six, respectively); front limb represented by a ‘button’-like scale (no trace and no reported trace, respectively); rear limb absent (short and paddle-like and no reported trace, respectively); longitudinal scale rows at mid-body 25 (34 and 32, respectively), and presacral vertebrae 67 (82 and unknown, respectively).

#### *Description*

*External morphology.* In general appearance, a large (SVL = 224 mm), pale, thick bodied (at mid-body, diameter 16.5 mm and circumference 51 mm), limbless skink with thin black lines running through centres of dorsal and upper lateral scales but with venter almost immaculate (ground colour reddish orange in life).

Snout conical; rostral large, totally encompassing nostril but with horizontal suture running posteriorly from nostril; dorsomedial edge of rostral gently posteriorly convex; supranasals large, with their rounded medial edges contacting anteromedially, extending ventrally to contact first supralabial; frontonasal with acute anterior projection due to converging medial edges of supranasals; frontal longitudinally divided (and hence giving the appearance of distinct frontoparietals), in aggregate, bell-shaped (Greer & Shea, 2000); supraoculars 2/1; frontoparietals absent; interparietal well separated from supraoculars; parietal eye and eyespot absent; parietals meet posterior to interparietal; nuchals 1/1.

Nasal absent, i.e. nostril entirely within rostral; postnasal absent; loreal single, slightly deeper than long, contacting first supraocular; preocular single; presubocular single; supraciliaries 2/1, closely abutting upper palpebrals, i.e. no deep palpebral cleft; postsuboculars two, both contacting penultimate supralabial; lower eyelid consisting of one or two scales, moveable; pretemporal single, large; primary temporal single; secondary temporals two, upper contacting pretemporal anteriorly, nuchal dorsoposteriorly, overlapping lower secondary temporal ventrally; tertiary temporal bordering posterior edge of lower secondary temporal single, large; supralabials five, third subocular; postsupralabial single; external ear opening absent, its former position indicated by an anteriorly dipping scaly crease.

Mental wider than long, posteriorly convex; postmental single, contacting single infralabial on each side; infralabials four (both extend beyond level of last supralabial); three pairs of large chin scales, members of first pair separated by one scale row, members of second pair separated by two scale rows, and members of third pair separated by four scale rows.

Body scales cycloid, glossy, perfectly smooth, each with a few very minute pits aligned parallel to posterior edge of scale; longitudinal scale rows at mid-body 25; paravertebrals 162; ventrals 155; inner preanals overlap outer; scales in mid-ventral caudal row similar in size to scales in adjacent rows. Front limb represented by a single, moderate sized 'button'-like scale in posterior part of a shallow, posteriorly dipping, crease; rear limb totally absent with no external trace of its former position.

SVL 224 mm; tail 35 mm, probably complete to judge from symmetry of terminal scales, their similarity to more anterior scales, and no other indication of regeneration.

*Soft anatomy*. Inguinal fat bodies present. Ovary without large follicles and oviduct narrow, suggesting specimen was reproductively quiescent.

*Skeletal features.* Premaxillae produced into short, narrow rostrum; jugal's postorbital process well developed; teeth sharply pointed; hyoid elements resolvable on radiographs include basihyal, glossohyal, hypohyal, ceratohyal, and ceratobranchials I and II; pectoral girdle consists of clavicle and scapulocoracoid; interclavicle cannot be resolved on radiographs; humeral fragment projects laterally (probably toward external 'button'-like scale); sternum present; mesosternum probably absent (no rib seems to contact sternal apparatus); complete inscriptional chevrons 18, first begins on eight presacral vertebra, all anteriorly projecting; pelvic girdle halves widely separated, each half consists of tri-partite element, each prong of which presumably represents ilium, pubis and ischium; no trace of rear limb bones; presacral vertebrae 67; taking first inscriptional chevron as homologous to first sternal rib of limbed species, then cervical vertebrae seven (instead of primitive eight); sacral vertebrae's pleurapophyses widely separated; postsacral vertebrae 16; caudal vertebrae's transverse processes project only slightly anteriorly; caudal autotomy plane lies within anterior part of transverse process; free ribs begin on third presacral; all ribs smooth-sided, i.e. without accessory processes.

*Colour in life*. Overall ground colour reddish orange (dorsum slightly darker than venter), with thin longitudinal black lines on the back, each running through centre of a longitudinal scale row, mid-lateral area unpatterned, but three or four poorly defined black lines through the centres of each longitudinal scale row on ventrolateral surface; venter without pattern; tail with black line through centre of each longitudinal scale row, dorsalmost lines most distinct; ocular region and front limb crease dark pigmented.

*Colour in preservative*. As in life but reddish of ground colour has faded to pale cream. Parietal peritoneum pale.

### *Etymology*

The specific name '*menamainty*' is a compound Malagasy word which is based on the words 'mena' for 'red' and 'mainty' for 'black' and refers to the red and black striped aspect of this skink in life. It is used here as a noun in apposition ('the red and black one'). The phonetic rendition is: *mai*na-*mai*nty (accented syllables italicized).

### *Distribution*

The species is known only for the Berara Forest on the Sahamalaza Peninsula. Apart from *Pseudoacontias madagascariensis*, whose distribution is still unknown (see Nussbaum & Raxworthy, 1995), the only other known species is the recently described *P. angelorum,* from the Marojejy Massif. Despite intensive searching in other areas of northwestern Madagascar (Sambirano Region, Manongarivo, Nosy Be), no other species of *Pseudoacontias* have been found until now. However, it is possible that *P. menamainty* might occur in forests south of Berara. Indeed, considering the apparent rarity of all three known species (each known from only a single specimen), any of the species might well occur in previously well-surveyed areas.

### *Habitat and habits*

See this section under *Amphiglossus tanysoma* n. sp. for the habitat description. Little can be said about the species' ecological preferences and behaviour. When handled the specimen never attempted to bite, but it did wriggle its body vigorously in trying to dig itself into the forest layer. Taking into consideration the almost complete absence of limbs, the relatively short tail, the pointed snout, and the general stoutness of the body, it seems probable that the species is fossorial and perhaps only active on the surface at night.

The conical snout, sharply pointed teeth, strong limb reduction and large size of this species are also features of another skink genus, the Australian lygosomine *Coeranoscincus*. Both species of this genus inhabit moist closed forest and the better known species, *C. reticulatus*, feeds, unusually for skinks, on earthworms (McDonald, 1977). By analogy, we suggest that vermivory may also be a feature of this, or perhaps even all, species of *Pseudoacontias* (teeth unknown in other two species).

### *Comparison with similar species*

Unfortunately the type and only known specimen of *Pseudoacontias madagascariensis* Barboza du Bocage, 1889 has been destroyed (E. G. Crespo, in Brygoo, 1980*b*) and hence today is known only from the brief original description and the accompanying simple, but confidence-inspiring, drawings of the dorsal and lateral view of the head. However, using those characters that are known or can be reasonably inferred for the species (such as the absence of any external trace of limbs, as the limbs are not mentioned in the original description), a limited comparison is possible between the species described here and the two earlier described species of *Pseudoacontias*. On this basis, *P. menamainty* is more primitive than *P. angelorum* and *P. madagascariensis* in three regards: loreal slightly deeper than long (*vs* much longer than deep); fewer longitudinal scale rows at mid-body (26 *vs* 34 and 32, respectively), and the retention of an external trace of the front limb, albeit only a flat, button like structure. In contrast, *P. menamainty* shares only one derived character with one of the species, *P. madagascariensis:* the total absence, externally, of the rear limb.

*Pseudoacontias menamainty* is unique in comparison to the other two species with regard to a character whose two states are of uncertain polarity. It has one tertiary temporal bordering the lower secondary temporal whereas the other two species have two (Barboza du Bocage, 1889: fig. 2 for *P. madagascariensis*). It may also be noted that the original description of *P. madagascariensis* says there were three supraoculars, but the figure shows only two; this compares with one on each side in *P. angelorum* and two on one side and one on the other in *P. menamainty.* The new species has three apparently derived character states, two of which are unique in comparison to the other two species and one of which may be shared with one of the species. The two unique derived character states are: a reduced number of supraciliaries, two or fewer *vs* four, and a reduced number of supralabials, five *vs* six. The possibly shared derived character state is the contact between the first supraocular and the loreal. *Pseudoacontias madagascariensis* clearly has the primitive condition of the first supraciliary in contact with the frontonasal thereby separating the first supraocular and loreal (Barboza du Bocage, 1889: figs 1 & 2). However, the condition in *P. angelorum* is ambiguous as the original figure (Nussbaum and Raxworthy, 1995: fig. 2) shows broad contact between the first supraocular and the loreal on the right side (dorsal view) but two different interpretations on the left side: narrow contact (dorsal view) and narrow separation (lateral view).

## GENERIC CONCEPTS AND DIAGNOSES

### *Amphiglossus* Duméril & Bibron, 1839 and *Androngo* Brygoo, 1982

The genus *Amphiglossus* as it is currently conceived (Brygoo, 1981*c*, 1985), basically consists of the most generally primitive members of the non-lygosomine skinks on Madagascar and the associated islands to the north-west. In other words, it encompasses all those non-lygosomine Malagasy species that lack the reduction of the head scales, the loss of an external ear opening, and the strong reduction of the limbs and attenuation of the body that characterize to various degrees all the other non-lygosomine genera of Malagasy skinks. It is, therefore, almost certainly a paraphyletic group. However, pending an analysis of the relationships of the non-lygosomine skinks, it is a useful genus of convenience.

The recently recognized genus *Androngo* was diagnosed as basically all those *Amphiglossus* with presacral vertebrae $\geq 48$ (Brygoo, 1981*c*, 1987). However, a high number of presacral vertebrae is a repeated trend in skinks, especially among the non-lygosomines (A. E. Greer, pers. obs.); hence it is highly unlikely that a relatively high number of presacral vertebrae, by itself, would successfully diagnose a group of species sharing an exclusive common ancestor. Indeed, diagnosing skink genera solely on the basis of the number of vertebrae is probably as 'reliable' as diagnosing skink genera solely on the number of digits (Günther, 1871; Boulenger, 1887).

The genus *Androngo* as currently conceived consists of the type species *A. trivittatus* and three other species: *A. alluaudi*, *A. crenni* and *A. elongatus* (Brygoo, 1981*c*, 1987). However, an equally strong case can be made for a closer relationship between *A. trivittatus* and *Pygomeles braconnieri.* For example, both species lack a postnasal and, as a probable consequence, the supranasal contacts the supralabials (Brygoo, 1987: figs. 1 & 2; pers. obs.; Brygoo, 1984*c*: fig.1; pers. obs., respectively). The other three species currently placed in *Androngo* do not show this feature. *Androngo trivittatus* and *Pygomeles braconnieri* also share a relatively high number of presacral vertebrae, 53–56 and 57–65, respectively. Of the other three species of *Androngo*, only *A. crenni* falls within this high range with 54–57. Furthermore, *Androngo trivittatus* and *Pygomeles braconnieri* occur in southern and drier areas, whereas the other three species of *Androngo* occur in more northern and wetter areas. These considerations suggest that the current concept of *Androngo* is not particularly compelling and lead us to reinstate *Androngo alluaudi*, A. *crenni* and *A. elongatus* in the genus *Amphiglossus* pending a more comprehensive analysis of relationships and to retain *Androngo* as a monotypic genus containing the species *A. trivittatus* with two subspecies*, A. t. trivittatus* and *A. t. trilineatus* (Brygoo, 1987).

Parenthetically, the subgeneric concept of *Madascincus* within *Amphiglossus* (Brygoo, 1981*c*, 1984*b*) also seems of little assistance in understanding relationships in that its two substantive characters, small size (SVL $<$ 80 mm) and low number of presacral vertebrae (29–30), are either of uncertain polarity (size) or almost certainly primitive (vertebrae).

### *Pseudoacontias* Barboza du Bocage, 1889

Compared to the generally primitive skinks in the genus *Eumeces*, especially the subgenus *Pariocela*, the genus *Pseudoacontias* shows the following derived character states: snout conical; prefrontals absent; frontal bell-shaped; supraoculars two or fewer; frontoparietals absent; parietal eyespot absent; nuchals in a single pair; nasal possibly absent (not evident in *P. angelorum*; Nussbaum & Raxworthy, 1995: fig.2; and unknown in *P. madagascariensis*); postnasal absent; loreal single; preocular single; pretemporal single; supralabials six or fewer, fourth or less subocular; external ear opening absent; front limb expressed as a 'button'-like scale or less externally and by no more than a humeral fragment internally; rear limb a small, paddle-like flap or less; presacral vertebrae $\geq 67$; colour pattern consists of thin dark lines running through centres of each dorsal longitudinal scale row; size large, smallest maximum snout vent length for any species = 200 mm (*P. madagascariensis*).

### *Paracontias* Mocquard, 1894

The genus *Paracontias* as currently conceived (Brygoo, 1980*b*) has the following derived character states: supranasals absent; prefrontals absent; pretemporal single; nasal greatly reduced; loreal single (*P. holomelas* may occasionally have two); preocular single; presubocular single; supralabials five, third subocular; postsupralabial single; infralabials contacted by postmental one; external ear opening absent; limbs absent without external trace of their former position; presacral vertebrae $\geq 46$; sternal ribs $\leq 2$; mesosternum absent; complete inscriptional chevrons $\geq 19$.

An interesting retained primitive character in *Paracontias*, especially *vis-à-vis* many *Amphiglossus*, including the strongly limb-reduced *A. stylus*, is the contact between the first supraocular and the frontonasal which thereby excludes the first supraciliary from contacting the frontal.

Three subgenera have been recognized within *Paracontias*: *Angelias* (Brygoo, 1980*b*), *Malacontias* (Greer, 1970) and *Paracontias* (Mocquard, 1894). We have not used these taxonomic groups because the two characters used to diagnose them as subgenera – the position of the nasal opening in relationship to the rostral scale and first supralabial scale, and the number of presacral vertebrae – do not result in monophyletic groups in all cases. *Angelias* (two species) is diagnosed on the basis of the primitive state in each character; *Paracontias* (one species) has as its only derived character the highest number of presacral vertebrae, and *Malacontias* (two species) is diagnosed on a derived scale arrangement and an intermediate number of presacral vertebrae. Hence only *Malacontias* or a group combining *Malacontias* + *Paracontias* (intermediate to high number of presacral vertebrae) is likely to be a true lineage on these characters.

**Key to the species of *Paracontias***

1. Longitudinal scale rows at mid-body 16–22 ............. 2
   Longitudinal scale rows at mid-body 26–30 ............. 6
2. Frontal hourglass-shaped, i.e. frontal constricted by first supraciliary ................................................ 3
   Frontal bell-shaped, i.e. frontal not constricted by first supraciliary ................................................ 5
3. Nasal entirely within rostral ................................... 4
   Nasal border by rostral and first supralabial *P. milloti*
4. Supralabials five ............................................ *P. hafa*
   Supralabials four ................................ *P. hildebrandti*
5. Nasal bordered by rostral and first supralabial ........................................................... *P. rothschildi*
   Nasal entirely within rostral ................................... 7
6. Frontal hourglass-like, i.e. frontal constricted by first supraciliary; supraoculars four........ *P. holomelas*
   Frontal bell-shaped, i.e. frontal not constricted by first supraciliary; supraoculars three...... *P. brocchi*
7. Supraoculars four; pretemporal separated from parietal; third pair of chin scales divided ..... *P. manify*
   Supraoculars three; pretemporal contacts parietal; third pair of chin scales entire ... *P. tsararano*

## MORPHOLOGICAL AND REPRODUCTIVE NOTES

### Postanal scale

Almost all of the apparent mature males of *Amphiglossus* in the collection have a distinctive scale on

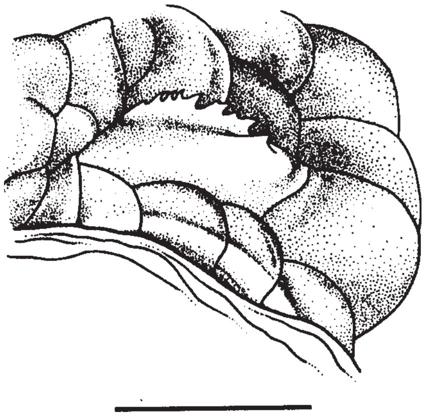

**Fig. 21.** Detail of enlarged postanal scale (left side) of *Amphiglossus melanopleura* (MRSN R1827) in oblique ventral view. Scale bar = 1 mm.

each side of the base of the tail just lateral to the vent. This scale varies interspecifically from slightly to appreciably larger than the adjacent scales and supports a single ridge or keel which, depending on the species, ranges from bluntly rounded to acutely saw-toothed. The species in the MRSN collections observed to have the large, ridged postanal scale in males are: *Amphiglossus astrolabi*, *A. crenni* (weak), *A. melanopleura* (strong), *A. melanurus*, *A. mouroundavae*, *A. praeornatus*, *A. punctatus*, *A. reticulatus* and *A. stumpffi* (weak). Sometimes the ridge carries moderately deep serrations, e.g. *A. melanopleura* (MRSN R1827; Fig. 21). In only one species, *A. praeornatus*, was a similar scale found in a female (MRSN R1716), but the ridging was not as strong as in the three similar-sized males.

Other species of *Amphiglossus* (sex not determined) with a similarly large and 'keeled' postanal scale include: *A. alluaudi* (MNHN A 647, holotype), *A. macrocercus*, *A. ornaticeps* (some specimens among the type series: BMNH 1946.8.2.72–76), *A. splendidus* (MNHN 1963.421) and *A. tsaratananensis* (MNHN A94, holotype) (A. E. Greer, pers. obs.). Interestingly, a slightly enlarged postanal scale also occurs in the males of the two species of *Cryptoblepharus*. In *Cryptoblepharus voeltzkowi*, the degree of enlargement is very subtle but five males and two females were accurately sexed using this feature (Fisher exact test, $P = 0.048$). The two male and three female *C. cognatus* were also accurately sexed using the postanal scale, but the sample size was too small for the test to attain significance (Fisher exact test, $P = 0.10$). Whether this subtle secondary sexual character occurs in other lygosomines remains to be explored.

## Colour pattern

A rather useful dichotomy in the basic colour pattern of *Amphiglossus* and its probable relatives on Madagascar is whether the darkest pigment is concentrated in the centres of the scales or on the edges. In first recognizing this difference in the taxonomically difficult *A. melanurus–A. gastrostictus–A. macrocercus* (MGM) complex, Brygoo (1984*a*: fig 1) named the first pattern after *A. melanurus* and the second after *A. macrocercus*. Unfortunately, the types of *A. macrocercus* have their only remaining melanin clearly distributed in the centres of the scales (A. E. Greer, pers. obs.) and hence the second of Brygoo's designations is not apt. As an alternative designation, we propose calling the two patterns central and lateral, based on where the concentration of pigment lies within each scale. The central pigment pattern is clearly more taxonomically widespread among *Amphiglossus*, as it occurs in most of the species we have examined in which a designation can be made. It also featured in 111 of 131 specimens of the MGM complex surveyed by Brygoo (1984*a*), whereas only 20 of the 131 specimens had the lateral pigment pattern. These 20 specimens were scattered among seven institutions, and we suspect that some of them may represent one or both of the new species described here with the lateral pigment pattern, *Amphiglossus spilostichus* or *A. mandady*.

## Parietal peritoneum

In skinks, the lining of the body cavity, the parietal peritoneum, can be pigmented, usually heavily so or pale. In Malagasy skinks a wide range of conditions is shown. The peritoneum is shiny black in *Cryptoblepharus cognatus, C. voeltzkowi*, *Mabuya boettgeri, M. comorensis, M. elegans*, *M. gravenhorstii* and *M. madagascariensis*. The peritoneum of *Mabuya aureopunctata* is also pigmented to some degree, but just how dark it may have been is difficult to determine due to the specimen's poor state of preservation.

In a few species of *Amphiglossus*, the parietal peritoneum is also dark, at least to some degree. In *A. macrocercus*, the parietal peritoneum is very dark. In *A. melanopleura*, it is brown, being moderately heavily streaked with pigment in smaller specimens and only lightly streaked in larger specimens. In the three examined specimens of *A. gastrostictus,* all of which are mature, the parietal peritoneum is very dark. In *A. mouroundavae*, the parietal peritoneum is lightly streaked in all specimens (most of which are medium to large). In the two specimens of *A. punctatus*, the parietal peritoneum is pale in the smaller specimen (SVL = 55 mm) but moderately brown streaked in the larger (SVL = 67 mm). And in the two *A. splendidus* specimens (MRSN R2201 and MNHN 1963.421), both of which are large, the peritoneum is very thinly streaked. However, in all the other species of *Amphiglossus* examined, the parietal peritoneum is pale: *Amphiglossus anosyensis*, *A. astrolabi*, *A. crenni*, *A. melanurus*, *A. ornaticeps*, *A. praeornatus*, *A. reticulatus* and *A. stumpffi*. It is also pale in *Paracontias hildebrandti* and *P. holomelas*.

The colour of the parietal peritoneum may provide an indirect clue to the amount of diurnal surface activity the species engages in. This is because in skinks a dark peritoneum is often, although not always (e.g. *Eumeces*), associated with diurnal surface activity and a pale peritoneum is often associated with either nocturnal and/or cryptozoic activity (A. E. Greer, pers. obs.).

## Phalangeal formula

The primitive phalangeal formula for the manus in skinks (and lizards) is 2.3.4.5.3 (Romer, 1956; A. E. Greer, pers. obs.). The phalangeal formula is reduced to 2.3.3.4.3 in *Amphiglossus anosyensis*, *A. astrolabi*, *A. gastrostictus* (including holotype), *A. macrocercus* (including lectotypes and paralectotypes), *A. melanopleura*, *A. melanurus* (including lectotype and paralectotypes), *A. mouroundavae*, *A. praeornatus*, *A. punctatus*, *A. ornaticeps*, *A. reticulatus, A. splendidus* and *A. stumpffi*. The formula is reduced even further in *A. crenni,* where it is also variable, being either 2.2.2 or 2.2. The phalangeal formula for the manus in *Cryptoblepharus cognatus*, *C. voeltzkowi*, *Mabuya aureopunctata, M. boettgeri, M. comorensis, M. elegans, M. gravenhorstii* and *M. madagascariensis* is 2.3.4.5.3.

The primitive phalangeal formula for the pes in skinks (and lizards) is 2.3.4.5.4 (Romer, 1956; A. E. Greer, pers. obs.). This is the formula for *Amphiglossus anosyensis*, *A. astrolabi*, *A. gastrostictus* (including holotype), *A. macrocercus* (including lectotype and paralectotypes), *A. melanopleura*, *A. melanurus*, *A. mouroundavae*, *A. ornaticeps*, *A. praeornatus*, *A. punctatus*, *A. reticulatus*, *A. splendidus* and *A. stumpffi*. However, the formula is reduced in *A. crenni*, where it is variable, being either 2.2.3.4.0 or 0.2.3.4.0. The phalangeal formula for the pes in the two species of *Cryptoblepharus* and the six species of *Mabuya* is 2.3.4.5.4.

## Sex ratio

In two species there are sufficient specimens to examine the sex ratio, and in both species males are significantly more common than females. In *Amphiglossus melanopleura* there are 21 males and eight females ($\chi^2 = 5.83$, $P < 0.05$), and in *A. mouroundavae* there are 21 males and 4 females ($\chi^2 = 11.6$, $P < 0.001$). These differences in comparison to the 1:1 primary sex ratio is probably because of a greater surface activity of males, while females are probably more secretive and difficult to find.

## Reproduction

The two female *Amphiglossus astrolabi* (MRSN R1143 and R1612) are large and presumably mature. However, in both specimens the ovary contains only small, pale follicles. The two specimens were collected in November 1992 and on 10 December 1996, respectively.

The two female *Amphiglossus crenni* are large and presumably mature. However, in both specimens the ovaries are quiescent. One specimen (MRSN R1733) was collected in the dry season on 2 June 1996 and one (MRSN R1735) in the wet season on 8 December 1997.

One of the two female *Amphiglossus gastrostictus* measures 106 mm SVL and is gravid (MRSN R1705.1) with four pigmented and scaled embryos, two in each oviduct. The other female (MRSN R1705.2) measures 98 mm SVL and seems to be spent or perhaps even reproductively quiescent. Both females were collected on 5 January 1996.

There are five female *Amphiglossus macrocercus.* Four of these, measuring 68.5–84 mm SVL, are immature whereas the largest (MRSN R1775), measuring 92 mm SVL and with a collection date of 11 January 1999, is gravid with five embryos (Vences *et al.*, in press). The only other Malagasy non-lygosomine skinks known to be live bearing, in addition to this and the preceding species, is *A. punctatus* (Raxworthy & Nussbaum, 1993).

Three ovigerous female *Amphiglossus melanopleura* range from 45 to 48.5 mm in SVL (mean = 46.8 mm) and contain two yolking follicles, one in each ovary. These females were collected on 1 and 3 December 1996 (MRSN R1741 and R1744, respectively) and on 14 December 1999 (MRSN R1828). The only gravid female (MRSN R1711) measures 40 mm SVL and contains three oviducal eggs, two in the right oviduct and one in the left. This specimen was collected on 5 December. The species has previously been reported as oviparous on the basis of a female measuring 50 mm SVL having laid six eggs on 29 December (Glaw & Vences, 1996).

A single female *Amphiglossus mouroundavae* measuring 63 mm SVL (MRSN R1771) and collected on 16 December 1997 contains a single egg in each oviduct. The eggs are shelled, confirming that the species is oviparous (Raxworthy & Nussbaum, 1993).

Of the two mature female *Amphiglossus praeornatus*, one (MRSN R1716) collected on 16 December 1999 and measuring 71 mm SVL has two yolking follicles in each ovary and the other (MRSN R1736) collected on 12 December 1996 (Tsararano) and measuring 65.5 mm SVL has two corpora lutea in each ovary.

The single *Amphiglossus ornaticeps* is an immature female measuring 45 mm SVL.

The two female *Amphiglossus stumpffi* are reproductively active. MRSN R1718 measures 96 mm SVL and contains two enlarging follicles in each ovary; it was collected on 14 February 2000. MRSN R1873 measures 87 mm SVL and contains two shelled eggs in each oviduct, providing the first evidence for oviparity in the species; it was collected on 30 January 2001.

The single female *Amphiglossus reticulatus* (MRSN R1723) measures 76 mm SVL and is immature.

All six female *Cryptoblepharus voeltzkowi* are mature to judge from their ovaries and oviducts. Three of these females are reproductive. Two (MRSN R1038

**Table 1.** Comparison of two potentially sexually dimorphic characters in various Malagasy skinks

| | Snout–vent length (mm) | | | | | | | | | Paravertebral scales | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Males | | | | Females | | | | | Males | | | | Females | | | | |
| Species | Range | Mean | SD | *n* | Range | Mean | SD | *n* | *P* | Range | Mean | SD | *n* | Range | Mean | SD | *n* | *P* |
| *Amphiglossus* | | | | | | | | | | | | | | | | | | |
| *anosyensis* | – | – | – | – | 34 | 34.0 | 1 | – | – | – | – | – | – | 71 | 71.0 | – | 1 | – |
| *astrolabi* | 221 | 221 | – | 1 | 184–199 | 191 | – | 2 | – | 98 | 98 | – | 1 | 103–105 | 104 | – | 2 | – |
| *crenni* | 140–152 | 146 | 5.68 | 4 | 150–164 | 157 | – | 2 | 0.24 | 116–132 | 124.5 | 6.76 | 4 | 126–130 | 128.0 | – | 2 | 0.64 |
| *gastrostictus* | – | – | – | – | 102–106 | 104 | – | 2 | – | – | – | – | – | 73–76 | 74.5 | – | 2 | – |
| *macrocercus* | 66–79 | 73.5 | 6.61 | 3 | 69–97 | 81.3 | 11.39 | 7 | 0.31 | 81–85 | 83.3 | 2.08 | 3 | 83–88 | 85.4 | 1.90 | 7 | 0.19 |
| *melanopleura* | 34–50 | 44.1 | 5.20 | 21 | 40–57 | 46.2 | 5.24 | 8 | 0.73 | 51–61 | 56.2 | 2.86 | 21 | 55–64 | 58.9 | 3.48 | 8 | 0.07 |
| *melanurus* | 69–84 | 76.5 | – | 2 | 63 | 63.0 | – | 1 | – | 87–91 | 89.0 | – | 2 | 80 | 80.0 | – | 1 | – |
| *mouroundavae* | 40.5–72 | 61.5 | 7.51 | 21 | 50–65 | 58.3 | 6.99 | 4 | 0.33 | 60–68 | 62.6 | 2.14 | 20 | 62–65 | 63.7 | 1.26 | 4 | 0.14 |
| *ornaticeps* | – | – | – | – | 45 | 45.0 | – | 1 | – | – | – | – | – | 88 | 88.0 | – | 1 | – |
| *praeornatus* | 65–71.5 | 67.7 | 2.66 | 6 | 46–71 | 60.8 | 13.14 | 3 | 0.52 | 67–69 | 67.8 | 0.75 | 6 | 65–70 | 67.0 | 2.64 | 3 | 0.42 |
| *punctatus* | 55–67 | 61.0 | – | 2 | – | – | – | – | – | 63–70 | 66.5 | – | 2 | – | – | – | – | – |
| *reticulatus* | 169–206 | 189 | 18.6 | 3 | 76 | – | – | 1 | – | 101–103 | 102.0 | 1.0 | 3 | 101 | – | – | 1 | – |
| *splendidus* | – | – | – | – | 97 | 97.0 | – | 1 | – | – | – | – | – | 79 | 79.0 | – | 1 | – |
| *stumpffi* | 79–103 | 93.4 | 11.8 | 4 | 87–96 | 91.5 | – | 2 | – | 84–87 | 85.0 | 1.41 | 4 | 87–88 | 87.5 | – | 2 | – |
| *Cryptoblepharus* | | | | | | | | | | | | | | | | | | |
| *cognatus* | 35.5–39 | 37.3 | – | 2 | 36–39 | 37.3 | 1.53 | 3 | – | 45–49 | 47.0 | – | 2 | 46–50 | 48.3 | 2.08 | 3 | – |
| *voeltzkowi* | 38–41.5 | 39.9 | 1.39 | 5 | 42–43.5 | 42.7 | – | 2 | 0.051 | 46–48 | 47.0 | 1.00 | 5 | 47–49 | 48.0 | – | 2 | 0.32 |
| *Mabuya* | | | | | | | | | | | | | | | | | | |
| *aureopunctata* | 78.5 | 78.5 | – | 1 | – | – | – | – | – | 50 | 50.0 | – | 1 | – | – | – | – | – |
| *boettgeri* | 42 | 42.0 | – | 1 | 40–55 | 47.8 | 4.76 | 6 | – | 51 | 51.0 | – | 1 | 48–53 | 49.8 | 1.83 | 6 | – |
| *comorensis* | 61–108 | 90.9 | 18.1 | 5 | – | – | – | – | – | 50.53 | 51.6 | 1.14 | 5 | – | – | – | – | – |
| *elegans* | 54.5 | 54.5 | – | 1 | 31–58.5 | 48.5 | 15.21 | 3 | – | 53 | 53.0 | – | 1 | 50–52 | 51.0 | 1.00 | 3 | – |
| *gravenhorstii* | 29–90.5 | 55.3 | 15.4 | 13 | 37.5–70 | 54.6 | 11.21 | 7 | 0.97 | 50–56 | 52.5 | 1.90 | 13 | 51–56 | 53.9 | 1.57 | 7 | 0.11 |
| *madagascariensis* | 68 | 68.0 | – | 1 | 60–63.5 | 61.7 | – | 2 | – | 56 | 56.0 | – | 1 | 59–60 | 59.5 | – | 2 | – |
| *Paracontias* | | | | | | | | | | | | | | | | | | |
| *hildebrandti* | – | – | – | – | 50 | 50.0 | 0 | 1 | – | – | – | – | – | 98 | 98.0 | – | 1 | – |
| *holomelas* | 125 | 125.0 | – | 1 | – | – | – | – | – | 133 | 133.0 | – | 1 | – | – | – | – | – |

**Table 2.** Comparison of three non-sexually dimorphic characters in various Malagasy skinks

| | Nuchals | | | Mid-body scale rows | | | Subdigital lamellae | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | Range | Mean | *n* | Range | Mean | *n* | Range | Mean | *n* |
| *Amphiglossus* | | | | | | | | | |
| *anosyensis* | 3 | 3.0 | 1 | 28 | 28.0 | 1 | 18 | 18.0 | 1 |
| *astrolabi* | 2 | 2.0 | 2 | 34–36 | 34.7 | 3 | 16–17 | 16.7 | 3 |
| *crenni* | 3–7 | 4.5 | 6 | 26–28 | 27.3 | 6 | 6–7 | 6.7 | 6 |
| *gastrostictus* | 2 | 2.0 | 2 | 28 | 28.0 | 2 | 15–16 | 15.5 | 2 |
| *melanopleura* | 0–7 | 4.6 | 20 | 24–26 | 24.1 | 29 | 9–16 | 12.2 | 29 |
| *melanurus* | 1–2 | 1.3 | 3 | 26–30 | 27.3 | 3 | 14–15 | 14.7 | 3 |
| *macrocercus* | 2–5 | 2.6 | 10 | 25–29 | 27.3 | 10 | 13–16 | 14.5 | 10 |
| *mouroundavae* | 0–2 | 1.7 | 24 | 28–32 | 30.0 | 25 | 17–21 | 18.4 | 25 |
| *ornaticeps* | 2 | 2.0 | 1 | 24 | 24.0 | 1 | 12 | 12.0 | 1 |
| *praeornatus* | 2–4 | 2.3 | 9 | 28–30 | 28.4 | 9 | 16–19 | 17.3 | 9 |
| *punctatus* | 4–6 | 5.0 | 2 | 22 | 22.0 | 2 | 20 | 20.0 | 2 |
| *reticulatus* | 4–6 | 4.5 | 4 | 39–40 | 39.3 | 4 | 13–15 | 14.0 | 4 |
| *splendidus* | 8 | 8.0 | 1 | 30 | 30.0 | 1 | 16 | 16.0 | 1 |
| *stumpffi* | 0–2 | 0.2 | 6 | 32–36 | 33.5 | 6 | 17–20 | 18.2 | 6 |
| *Cryptoblepharus* | | | | | | | | | |
| *cognatus* | 2–4 | 3.0 | 5 | 22 | 22.0 | 5 | 17–20 | 18.4 | 5 |
| *voeltzkowi* | 2–3 | 2.2 | 5 | 22–24 | 23.0 | 8 | 16–19 | 18.0 | 8 |
| *Mabuya* | | | | | | | | | |
| *aureopunctata* | 2 | 2.0 | 1 | 36 | 36.0 | 1 | 19 | 19.0 | 1 |
| *boettgeri* | 2 | 2.0 | 7 | 28–33 | 29.8 | 6 | 16–18 | 17.0 | 7 |
| *comorensis* | 2 | 2.0 | 5 | 32–34 | 32.8 | 5 | 22–24 | 22.4 | 5 |
| *elegans* | 2 | 2.0 | 4 | 30–34 | 32.5 | 4 | 17–21 | 19.5 | 4 |
| *gravenhorstii* | 2–4 | 2.1 | 21 | 31–36 | 33.0 | 20 | 17–21 | 19.0 | 21 |
| *madagascariensis* | 2 | 2.0 | 3 | 32–36 | 34.0 | 3 | 17–18 | 17.3 | 3 |
| *Paracontias* | | | | | | | | | |
| *hildebrandti* | 2 | 2.0 | 2 | 18 | 18.0 | 1 | – | – | – |
| *holomelas* | 2 | 2.0 | 1 | 30 | 30 | 1 | – | – | – |

and R1788) measuring 40 and 36 mm SVL and collected on an unknown date and on 14 February 1999, respectively, carry yolking follicles, and one (MRSN R1812) measuring 43.5 mm SVL and collected on 30 December 1997 carries two shelled eggs, one in each oviduct.

A *Mabuya boettgeri* (MZUT R426) measuring 55 mm SVL, but without collecting date, contains two large yolking follicles, one in each ovary. Two other females (MRSN R1875 and MRSN R1884) measuring 47.5 and 48.5 mm, respectively, contain two shelled oviducal eggs, providing the first evidence for oviparity in the species. The latter two females were collected on 10 January 1999 and between 3 and 10 December 1998, respectively.

The two mature female *Mabuya elegans* (MRSN R1730 and MRSN R1817) collected on 15 May 1994 and in December 1997, respectively, are both reproductively quiescent to judge from the presence of only small pale follicles in the ovary, although the oviducts are thick and convoluted.

Among the seven female *Mabuya gravenhorstii*, the three smallest, measuring 37.5, 45 and 52 mm in SVL, are immature, and the four largest, measuring 53, 60.5, 64 and 70 mm SVL, are mature. Of the latter four, the smallest (MZUT R434) and largest (MRSN R1823) specimens, collected on an unknown date and 4 January 1998, respectively, carry two and four, large yolking follicles, respectively; the second smallest specimen (MRSN R1819) collected on 1 January 1998, carries five shelled oviducal eggs, and the second largest specimen (MRSN R1880) collected on 15 February 1999 is reproductively quiescent.

Of the two female *Mabuya madagascariensis*, one (MRSN R1885) measuring 63.5 mm SVL is mature but reproductively quiescent to judge from its small, pale follicles and wide but thin-walled oviducts; it was collected on 3–10 October 1998. The other specimen (MRSN R1785), measuring 60 mm SVL carries five yolking follicles; it was collected on 9 January 1999.

In summary, if one concentrates on just oviducal contents, i.e. eggs or young, the oviparous species are gravid in December and January (*Amphiglossus melanopleura*, *A. mouroundavae*, *Cryptoblepharus voeltzkowi, Mabuya boettgeri* and *M. gravenhorstii*) and the ovoviviparous species are gravid in January and February (*A. gastrostictus* and *A. macrocercus*). These periods correspond to the early to mid-wet season. A summer/wet reproductive season seems to be widespread in Malagasy squamates (Glaw & Vences, 1996).

## TAXONOMIC, DISTRIBUTIONAL AND ECOLOGICAL NOTES

Here we make some comments on various aspects of the taxonomy, distribution and ecology of some of the previously described species which are housed in the MRSN and which formed part of this study.

**Table 3.** Comparison of the number of pre- and postsacral vertebrae in various Malagasy skinks

| | Presacral | | | | | | | | Postsacral | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Males | | | | Females | | | | Males | | | | Females | | | |
| Species | Range | Mean | SD | *n* | Range | Mean | SD | *n* | Range | Mean | SD | *n* | Range | Mean | SD | *n* |
| *Amphiglossus* | | | | | | | | | | | | | | | | |
| *anosyensis* | – | – | – | – | 35 | 35.0 | – | 1 | – | – | – | – | – | – | – | – |
| *astrolabi* | 38 | 38 | – | 1 | 38 | 38.0 | – | 2 | – | – | – | – | – | – | – | – |
| *crenni* | 54–57 | 55.7 | 1.26 | 4 | 56–57 | 56.5 | – | 2 | – | – | – | – | – | – | – | – |
| *gastrostictus* | – | – | – | – | 35 | 35.0 | – | 2 | – | – | – | – | – | – | – | – |
| *macrocercus* | 39–41 | 39.7 | 1.15 | 3 | 40–43 | 41.0 | 1.00 | 7 | – | – | – | – | 65 | – | – | 1 |
| *melanopleura* | 30–31 | 30.2 | 0.43 | 18 | 30–31 | 30.4 | 0.48 | 7 | 48–51 | 50.0 | – | 3 | – | – | – | – |
| *melanurus* | 43 | 43.0 | – | 3 | – | – | – | – | – | – | – | – | – | – | – | – |
| *mouroundavae* | 30 | 30.0 | – | 21 | 30 | 30.0 | – | 4 | 48 | 48.0 | – | 1 | 52 | – | – | 1 |
| *ornaticeps* | – | – | – | – | 43 | 43.0 | – | 1 | 57+ | – | – | 1 | – | – | – | – |
| *praeornatus* | 32–34 | 33.0 | 0.71 | 5 | 33 | 33.0 | – | 3 | – | – | – | – | – | – | – | – |
| *punctatus* | 31–33 | 32.0 | – | 2 | – | – | – | – | 53 | 53.0 | – | 1 | – | – | – | – |
| *reticulatus* | 37 | 37.0 | – | 3 | 37 | – | – | 1 | – | – | – | – | 58 | – | – | 1 |
| *splendidus* | – | – | – | – | 35.5 | 35.5 | – | 1 | – | – | – | – | – | – | – | – |
| *stumpffi* | 40–42 | 41.0 | 0.82 | 4 | 42 | 42.0 | – | 1 | – | – | – | – | – | – | – | – |
| *Cryptoblepharus* | | | | | | | | | | | | | | | | |
| *cognatus* | 26–27 | 26.5 | – | 2 | 27 | 27.0 | – | 3 | – | – | – | – | – | – | – | – |
| *voeltzkowi* | 27 | 27.0 | – | 4 | 27–28 | 27.5 | – | 2 | – | – | – | – | – | – | – | – |
| *Mabuya* | | | | | | | | | | | | | | | | |
| *aureopunctata* | 26 | 26.0 | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – |
| *boettgeri* | 26 | 26.0 | – | 1 | 26–27 | 26.2 | – | 6 | 49 | 49.0 | – | 1 | – | – | – | – |
| *comorensis* | 26 | 26.0 | – | 5 | – | – | – | – | – | – | – | – | – | – | – | – |
| *elegans* | 26 | 26.0 | – | 1 | 26 | 26.0 | – | 3 | – | – | – | – | – | – | – | – |
| *gravenhorstii* | 26–27 | 26.1 | 0.28 | 13 | 26 | 26.0 | – | 7 | 54–56 | 55.0 | – | 2 | – | – | – | – |
| *madagascariensis* | 25 | 25.0 | – | 5 | 26 | 26.0 | – | 1 | – | – | – | – | – | – | – | – |
| *Paracontias* | | | | | | | | | | | | | | | | |
| *hildebrandti* | – | – | – | – | 55 | 55.0 | – | 1 | – | – | – | – | – | – | – | – |
| *holomelas* | 57 | 57.0 | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – |

### ***Amphiglossus anosyensis* Raxworthy & Nussbaum, 1993.**

The single specimen in the collection is a small immature female. Taxonomically important morphological features supplementary to the original description are as follows: supraciliaries 6/8, first supraciliary just contacts (left side) or is narrowly separated from (right side) frontal; parietal eyespot clear and parietal eye evident; nuchals 1/2; auricular lobules along anterior edge of external ear opening, two to three, short, narrow, fleshy and blunt; three pairs of large chin scales, members of first pair in contact, members of second pair separated by one scale row, and members of third pair separated by three scale rows (see also Tables 1–3).

### ***Amphiglossus astrolabi* Duméril & Bibron, 1839**

The three available specimens form two groups on the basis of their supraciliary morphology and lateral colour pattern. Two specimens (MRSN R1727, male and MRSN R1622, female) have the supranasals separated, the supraciliary row continuous, and a dark brown dorsal ground colour which on the flanks is disposed in longitudinal rows through the centres of the scales. In contrast, one specimen (MRSN R1143, female) has the supranasals in contact, the supraciliary row interrupted by the posterior part of the second and all of the third supraocular extending laterally to the upper palpebral scale row, and a fawn brown dorsal ground colour which on the flanks is diffuse.

Ecological data are available for two specimens. MRSN R1622 was found in a small stream (the Tsararano) at 16:00 on 10 December 1996. It tried to escape by swimming and hiding under a half submerged log. MRSN R1727 was found almost motionless at the border of a small stream at 17:30 on 18 December 1999. It did not try to escape when approached.

### ***Amphiglossus crenni* (Mocquard, 1906)**

The six available specimens form two groups based on the digital morphology and number of longitudinal scale rows at mid-body. Two specimens (MRSN R1709, R1713) have digits 3/4, phalanges ?/.2.2.3.4 and scale rows 26 whereas four specimens (MRSN R1801, R1733–1735) have digits 2/3, phalanges 2.2/2.3.4, and scale rows 28. The significance of these differences is unclear. The holotype has digits 2/3 and scale rows 26 (Mocquard, 1906) while a second specimen has digits 2/2 and scale rows 26 (Brygoo, 1987).

All the MRSN specimens were captured in pitfall traps, confirming the utility of this kind of trap for surveying fossorial animals such as limb-reduced skinks and typhlopid snakes.

**Fig. 22.** *Amphiglossus crenni* from Masoala Forest hanging by its tail.

The species has a degree of prehensility in its tail. All the individuals when handled showed an ability to curve the tail around a human finger (Fig. 22). Sometimes it was even possible to hang an individual on a small branch by its tail. The significance of such behaviour is elusive. However, in that the species is unlikely to be arboreal, it does show that a behaviour that would be useful in an entirely different life style, e.g. arboreality, can evolve in an apparently totally different context.

### *Amphiglossus gastrostictus* (O'Shaughnessy, 1879)

Comparison of these three specimens with the holotype (BMNH 1946.8.21.24) from 'Madagascar' indicates that they are very similar, differing primarily in their larger size (SVL = 97–104 mm *vs* 78 mm, respectively) and for MRSN R1705.1–2, in their generally darker colour. The holotype and these three specimens share three distinctive features: a diffuse distribution of the dark brown colour on the flanks, a slightly squarish body in cross section and a dark parietal peritoneum. In most other *Amphiglossus* the pattern is much more uniform and the body is rounded (also squarish in *A. splendidus*).

### *Amphiglossus macrocercus* (Günther, 1882)

Comparison of the 10 MRSN specimens with the lectotype (BMNH 1946.8.14.45) and six paralectotypes (BMNH 1946.8.14.46–51) of *Amphiglossus macrocercus* from East Betsileo failed to reveal any significant differences between the two lots. However, the type series is in very poor condition and only partially informative as to colour pattern (above). Most of the scale covers have been lost and as a result the colour pattern is reduced to a dingy grey with melanin evident only in the central base of the scales. Importantly, the MRSN specimens all have a very dark spot at the base of each scale and were these specimens to fade as much as the type series, this spot would likely be the only remaining pattern.

### *Amphiglossus melanopleura* (Günther, 1877)

Among the MRSN specimens the degree of dark spotting on the throat is variable, a feature previously noted by Brygoo (1984*b*). Most specimens have an immaculate throat, but in some specimens from Parc National de Andohahela (MRSN R1147.1, R1147.3, R1196.1, R1196.3), Besariaka (MRSN R1741) and Andasibe (MRSN R1181) the throat is mildly to strongly spotted. There is no obvious geographic pattern to this colour variation.

All 40 specimens examined have, bilaterally, six supralabials with the fourth subocular. Hence none show as a variant, the five supralabials with the third subocular of the otherwise very similar *Amphiglossus ankodabensis* (Angel, 1930; Brygoo, 1984*b*).

Specimens of *Amphiglossus melanopleura* come from a wide altitudinal range (5 to *c*. 1100 m) allowing examination of the relationship between morphology and altitude. Two of the meristic characters showed significant altitudinal variation. Both the number of longitudinal scale rows at mid-body and the number of subdigital lamellae on the fourth toe showed a negative correlation with altitude ($r = -0.34$, $P = 0.045$, $n = 35$ and $r = -0.61$, $P < 0.001$, $n = 35$, respectively); i.e. the number of scales in each of these two scale series declines with increasing altitude.

At Andohahela, *Amphiglossus melanopleura* was active diurnally and was one of the most common reptiles of the study area (Andreone & Randriamahazo, 1997). At the other sites, *A. melanopleura* was only rarely observed active during the day, although the pitfall captures were almost always made during the day.

### *Amphiglossus melanurus* (Günther, 1877)

Based on a comparison of type specimens, there is little doubt that *Amphiglossus melanurus* is distinct from *A. macrocercus*, the species with which it is most often compared. Comparison of the lectotype (BMNH 1946.8.20) and two paralectotypes (BMNH 1948.8.20.95 and 1946.8.21.35) of *A. melanurus* from 'Anzahamaru' and 'Mahanora' with the lectotype (BMNH

1946.8.14.45) and six paralectotypes (BMNH 1946.8.14.46–51) of *A. macrocercus* suggests the former differs from the latter as follows: size smaller, SVL 43.5–59 mm *vs* 79–97 mm ($n = 6$); superciliaries usually six (six cases) *vs* either six (three cases) or seven (five cases); tertiary temporals bordering lower secondary temporal two (six cases) *vs* one (six cases) or two (two cases); rear limb as a proportion of SVL slightly shorter, 0.18–0.19 ($n = 3$) *vs* 0.21 ($n =$ only 2, due to poor condition of specimens) and presacral vertebrae 42–43 ($n = 3$) *vs* 38–39 ($n = 4$). The slightly shorter limbs, noted by Boulenger (1887) as the primary distinguishing character of *A. melanurus vis-à-vis A. macrocercus*, is especially relevant considering the smaller size of the former species. Were the two forms conspecific, one would expect the relative limb length of the smaller specimens to be greater. Two additional differences between *A. melanurus* and *A. macrocercus* based on the fresh MRSN material are, respectively: parietal peritoneum pale *vs* dark and the ground colour of underside of tail dusky *vs* pale.

The three MRSN specimens of *A. melanurus* are somewhat larger than the three types (SVL: 63–84 mm *vs* 43.5–59 mm) but whether this is anything other than sampling bias only additional specimens will tell.

### *Amphiglossus mouroundavae* (Grandidier, 1872)

The most recent review of this species characterized it as lacking an interparietal scale (Brygoo, 1984*b*). However, in the MRSN sample of 25 specimens, 13 have the interparietal and 12 lack it. There is no apparent correlation with sex (Fisher exact test, $P = 1.00$), although the number of females ($n = 4$) is small.

When present, the interparietal is relatively small and variable in size. A distinctive feature of all specimens is the absence of a parietal eye. This apparent parallel reduction in the two features suggests that a developmental link may exist between them.

### *Amphiglossus ornaticeps* (Boulenger, 1896)

Based on the single available specimen (MRSN R1148), taxonomically relevant characteristics not previously figured or described include: first supraciliary in strong contact with frontal; supraciliaries six, and tertiary temporal bordering lower secondary temporal single. The dusky underside of the tail, alluded to in the type description ('tail dark brown'), is distinctive.

### *Amphiglossus praeornatus* (Angel, 1938)

Contrary to the conclusion of the most recent taxonomic review of *Amphiglossus praeornatus* (Brygoo, 1980*c*), we believe this species is distinct from *Amphiglossus frontoparietalis*. The most obvious difference is in the relative length of the rear leg: 32–36% of SVL length in the former species ($n = 7$) and 'over half the SVL' in the latter (Boulenger, 1889). This difference in relative leg length is very apparent in the figures of the two holotypes: *A. praeornatus* (Angel, 1942: plate 21, fig. 4) and *A. frontoparietalis* (Brygoo, 1980*c*: fig.1). The original describer of *A. praeornatus* recognized this difference as a key character *vis-à-vis A. frontoparietalis* (Angel, 1942), but the most recent reviser ascribed the difference to intraspecific variation (Brygoo, 1980*c*). However, the difference is almost certainly interspecific. The holotype of *A. praeornatus* has a SVL of 43 mm and the holotype of *A. frontoparietalis* has a SVL of 62 mm and were the difference due to ontogeny, the smaller specimen should have a relatively larger leg length instead of smaller. Furthermore, our seven specimens on which the relative limb length of 32–36% of SVL is based, are similar in size to the holotype of *A. frontoparietalis* (65.0–71.5 mm *vs* 62 mm). Whatever other differences exist between the species must await detailed comparisons of additional specimens, especially the two types.

### *Amphiglossus punctatus* (Nussbaum & Raxworthy, 1993)

Taxonomically important morphological features supplementary to the original description are as follows: supraoculars contacting frontal three (MRSN R1774) or four (MRSN R1808); parietal eyespot small; supraciliaries seven in three cases and eight in one; first supraciliary well separated from frontal (MRSN R1774) or broadly contacting frontal (MRSN R1808); postmental contacting first two infralabials on each side; three pairs of large chin scales, members of first pair in contact, members of second pair separated by one scale row, and members of third pair separated by three scale rows; tongue dark distally, pale basally; premaxillary teeth seven.

The localities given in the original description of this species were: the Marovony Forest (next to Tolagnaro), Ambatovaky Special Reserve, Nahampoana, Ampamakiesiny Pass and Vatoharanana (Ranomafana N.P.) (Raxworthy & Nussbaum, 1993). Vatoharanana and Ambatovaky are in central eastern Madagascar, while the remaining localities are in south-eastern Madagascar, next to Tolagnaro (Fort Dauphin). The specimens from Anjanaharibe-Sud (already reported by Raxworthy *et al.*, 1998), Marojejy (Raselimanana *et al.*, 2000) and Besariaka (present paper) extend the species' distribution well to the north. This skink was not found at five sites visited in the Masoala Peninsula or at Tsararano, but this is probably the result of a research deficiency rather than to a real absence.

### *Amphiglossus reticulatus* (Kaudern, 1922)

*Amphiglossus reticulatus* remains a poorly known species (Brygoo, 1980*b*). It has not been found in any of the recent herpetological surveys. This species is very similar to *A. waterloti* (Angel, 1930) in morphology and colour pattern as noted by the most recent reviewer (Brygoo, 1980*b*). However, in that review, both species were maintained as distinct on the basis of a difference in the number of longitudinal scale rows at mid-body and the number of ventral scales between the type of the former and four specimens, including the type, of the latter (38 *vs* 42 and 91 *vs* 102–105, respectively). We note that the four MRSN specimens discussed here are closer in longitudinal scale row counts (39–40) to *A. reticulatus* but more similar to *A. waterloti* in the number of ventral scales (102–109). Therefore, these counts support the interpretation of close similarity between the two forms. However, to err on the side of caution, we continue to consider the two species as distinct pending a comparison of further specimens. A distinctive characteristic of *A. reticulatus* as represented by the MRSN specimens is the absence of the supraciliary scales lateral to the posterior part of the second and all of the third and fourth supraoculars. This morphology is very similar to that in one of the MRSN *Amphiglossus astrolabi* noted above. *Amphiglossus reticulatus* has been recognized previously as an aquatic species (Raxworthy & Nussbaum, 1993), and the MRSN specimens support this observation. All the specimens were found immersed in the water of a small temporary stream at Berara Forest (Sahamalaza Forest; see Andreone, Mattioli *et al.*, 2001). They were only found during the night, differing therefore in activity time from the *A. astrolabi*, which were found only during the day.

### *Amphiglossus splendidus* (A. Grandidier, 1872)

In addition to the one MZUT specimen, we have also examined two other specimens, MNHN 7734 (holotype) and MNHN 1963.421. In all but one side of one specimen (MNHN 1963.421) there are two loreals, one anterior and one posterior. In the one exception, there is only one loreal as in all other *Amphiglossus*. Two loreals is the primitive condition for skinks, and hence the question arises whether two loreals in this species is primitive or secondarily derived.

### *Amphiglossus stumpffi* (Boettger, 1882)

In the most recent consideration of this species' taxonomy it was suggested that analysis of additional material might lead to this species, originally from Nosy Be, being considered as a subspecies of the main island species *A. polleni* (Brygoo, 1980*a*, 1984*d*). However, in addition to the slight differences in scale counts and number of presacral vertebrae previously identified, we note that, based on a comparison of the types of the two forms, *A. stumpffi* has an hourglass-shaped frontal (see also Brygoo, 1980*a*: fig.3B; Greer & Shea, 2000) whereas *A. polleni* has a bell-shaped frontal (Brygoo, 1980*a*: fig. 3A). Therefore, we believe that the two forms are probably distinct species and the MRSN records of *A. stumpffi* are the first for the main island. All the specimens were captured in pitfall traps and found on the morning check, suggesting the species is nocturnal and/or crepuscular. None was ever observed during opportunistic searching.

### *Cryptoblepharus cognatus* (Boettger, 1881)

In the only comprehensive taxonomic treatment of *Cryptoblepharus*, all the many forms (now some 36) were considered to be subspecies of the species *C. boutonii*, the type locality of which is the Indian Ocean island of Mauritius (Mertens, 1931, 1933, 1934, 1964). This subspecific treatment was maintained in a subsequent taxonomic review of the forms of the islands of the western Indian Ocean (Brygoo, 1986). However, the long-appreciated distinct colour patterns and ecologies of at least some of the forms and the more recent recognition of sympatric occurrence of others, such as those in Australia, calls into question the interpretation of one polytypic species. In fact, it is now quite certain that many forms are distinct species while the status of other forms is uncertain. However, in the absence of a review of this problem, we think an interpretation that treats the forms of uncertain status as species instead of subspecies is probably closer to the real situation than is an interpretation that still identifies one species with vastly disjunct populations. Especially difficult is the taxonomy of the separate island forms such as occur on Madagascar and its neighbouring islands. For the present discussion, two of these forms are relevant, *C. cognatus* from the island of Nosy Be off the north-west coast of Madagascar and *C. voeltzkowi* from the main island. In the first and still only comprehensive taxonomic review of the genus (Mertens, 1931), the differences between the two forms were: *Cryptoblepharus cognatus* with three supralabials anterior to the subocular supralabial; 22 mid-body scale rows, and diffuse colour pattern and *C. voeltzkowi* with generally four supralabials anterior to the subocular supralabial, but sometimes three; 24 mid-body scale rows, and a more defined colour pattern. However, it was allowed that the difference might be because of the small sample sizes of both forms, two and four, respectively. A subsequent regional review (Brygoo, 1986), which also included specimens of *C. cognatus* from Nosy Be's neighbouring small island of Ambariobe (from where we have specimens), concluded that the two forms differed in the two scale features outlined above as well as a tendency for the prefrontals to be separated from one another more frequently in the former (seven of 15 specimens) than in the latter (one of 28), although there was no single definitive difference. On the basis of both our data (below) and that of the recent regional reviewer of the genus (Brygoo, 1986) on the prefrontal condition (contact *vs* separated), number of supralabials anterior to the subocular supralabial (three *vs* four, but counted

**Table 4.** Variation in some taxonomically important characters in Malagasy species of *Mabuya* examined in this paper. Superscripts for the supraciliary scale row and the secondary temporal configuration characters (see *M. boettgeri* account and Greer & Broadley, 2000) are for bilateral cases and those for the pterygoid teeth character are for individuals

| Species | *n* | Supraciliary row contacts prefrontal | Pretemporals contacted by parietal | Secondary temporal configuration | Rows of scales dorsal to eyelid window | Pterygoid teeth present or absent |
|---|---|---|---|---|---|---|
| *Mabuya* | | | | | | |
| *aureopunctata* | 1 | $-^{2}$ | 1 | $2S^{2}$ | 1 | $+^{1}$ |
| *boettgeri* | 7 | $+^{13}/-^{1}$ | 1 | $2S^{11}/2C^{3}$ | 1 | $-^{4}$ |
| *comorensis* | 5 | $+^{10}$ | 2 | $2S^{10}$ | 1 | $+^{1}$ |
| *elegans* | 4 | – | 1 | $2S^{7}/2C^{1}$ | 2 | $-^{2}$ |
| *gravenhorstii* | 21 | $+^{3}/-^{37}$ | 1 | $2S^{42}$ | 2 | $-^{8}$ |
| *madagascariensis* | 3 | $+^{4}/-^{2}$ | 1 | $2S^{6}$ | 2 | $-^{1}$ |

here on both sides and expressed as a total of seven or fewer *vs* eight or more) and the number of mid-body scale rows, there are highly significant differences between *C. cognatus* and *C. voeltzkowi* in all three features: prefrontals (Fisher exact test, $P = 0.0006$), supralabials anterior to subocular (Fisher exact test, $P = 0.004$), and mid-body scale rows (Mann–Whitney test = 138, $P < 0.0001$). We believe these differences support treating the two forms as distinct species. Of the five specimens we recognize as *Cryptoblepharus cognatus*, one comes from Nosy Be itself (MRSN R1874) and four (MRSN R1788–91) come from neighbouring Ambariobe. In these five specimens all have 22 mid-body scale rows; only the specimen from Nosy Be has three supralabials anterior to the subocular supralabial but only on one side, and only one specimen from Ambariobe has the prefrontals separated. Furthermore, the specimens are darker in colour and have a pattern that is slightly more contrasting than our specimens of *C. voeltzkowi*.

### *Cryptoblepharus voeltzkowi* (Sternfeld, 1918)

In our eight specimens from the main island of Madagascar, only four have 24 mid-body scale rows, the other four have 22; all specimens have four supralabials anterior to the subocular supralabial, and all have the prefrontals in contact. Furthermore, the specimens are paler in colour and have a pattern that is more diffuse than in our specimens of *C. cognatus*. Previously, *Cryptoblepharus voeltzkowi* has been known only from the south-western coast of Madagascar (Brygoo, 1986: map 2), but six of our specimens (MRSN R1809–14) extend the range to the southeastern coast (Tolagnaro = Fort Dauphin).

### *Mabuya aureopunctata* A. Grandidier, 1867

This and two other Malagasy species of *Mabuya* examined in this work, *M. elegans* and *M. gravenhorstii*, seem to have a previously unrecognized derived character state within the genus. In most skinks with relatively unmodified head scales, including those in the genus *Eumeces*, the first supraciliary and prefrontal meet broadly, but in some species of *Mabuya*, such as the three Malagasy species just mentioned, the first supraciliary and prefrontal are widely separated (Table 4; A. E. Greer, pers. obs. for other species).

### *Mabuya boettgeri* Boulenger, 1887

The four specimens from the two localities (below) differ in two morphological features. The six specimens from Ankaratra Massif (except for one side of one individual) all have the two secondary temporals separated by a tertiary temporal (2S configuration of Greer & Broadley, 2000) and two postsupralabials, whereas the single specimen from Valle dell'Umbi (Andrangoloka) has, bilaterally, the two secondary temporals in contact (2C configuration), as does the one exception from the Ankaratra Massif, and one postsupralabial (Table 4). These two features would be worth checking in other specimens of *Mabuya boettgeri.*

### *Mabuya comorensis* (Peters, 1854)

This species was recently discussed by Köhler, Glaw & Vences (1997). Its presence at Nosy Tanikely is most likely the result of a recent introduction from Comoros. Interestingly, despite the identification provided by Köhler *et al.* (1997), Ramanamanjato, Nussbaum & Raxworthy (1999) quoted the species at Nosy Tanikely as *M. maculilabris.* The five MRSN *Mabuya* collected at Nosy Tanikely correspond in morphology and colour to *M. comorensis.* In particular, these specimens show the large size (maximum SVL = 108 mm) and relatively high supraciliary (six), mid-body scale row (32–34) and subdigital lamellae counts (22–24) of *M. comorensis* (Brygoo, 1981*b*).

### *Mabuya elegans* (Peters, 1854)

The only juvenile (MRSN R1173) amongst the four specimens measures 30.5 mm in SVL and has only three keels on each dorsal body scale. The three adults measure 53.5–59 mm and have five or six keels on each scale. Hence, this seems to be yet another species of *Mabuya* in which the number of keels increases with size (A. E. Greer, pers. obs.).

### *Mabuya gravenhorstii* Duméril & Bibron, 1839

This is a widely distributed species that occurs almost everywhere in Madagascar (Raxworthy, 1988; Andreone, 1991). Such a broad distribution suggests that the species could be composite. As intimated, but not quantified, in an earlier study (Brygoo, 1983), there is a correlation between the modal number of keels (three to six) on the individual dorsal scales and SVL ($r_s = 0.77$, $P < 0.001$, $n = 21$) indicating that the number of keels increases with size. *Mabuya gravenhorstii* has a dark lateral stripe which in males becomes invested with small white spots from anteriorly to posteriorly. In specimens with or exceeding the SVL (52 mm) of the smallest specimen with white spots, the spotting occurs in six of eight males and in none of five females (sign test $P = 0.016$). Furthermore, among all males there is a strong correlation between size and the degree of spotting which was scored as absent, weak, strong: $r_s = 0.72$, $P < 0.01$, $n = 13$.

### *Paracontias hildebrandti* (Peters, 1880)

The osteology of this species is virtually unknown, but on the basis of the radiographs of our single specimen we can report the following details (primitive condition for skinks in brackets, if specimen shows a derived condition): presacral vertebrae 55 (26); first free ribs begin on fourth presacral vertebra; ribs lack accessory processes; clavicle present; scapulocoracoid present; pelvic girdle halves separated (joined), pubis and ischium reduced to short (much longer) tines of ilium, and no trace of rear limb (limb well developed).

### *Paracontias holomelas* (Günther, 1877)

The osteology of this species is also virtually unknown, but on the basis of the radiographs of our single specimen we can report the following details (primitive condition for skinks in brackets, if specimen shows a derived condition): ceratobranchial I present; presacral vertebrae 57 (26); cervical vertebrae six (eight); first free ribs begin on third (fourth) presacral vertebra; ribs lack accessory processes; complete inscriptional chevrons 21 (usually two to three); sacral diapophyses tapering distally (expanding) and separated or only loosely joined distally (fused); clavicle present; scapulocoracoid present, and sternum present; pelvic girdle halves separated (joined), pubis and ischium reduced to short (much longer) tines of ilium, and no trace of rear limb (limb well developed).

## CONSERVATION CONSIDERATIONS

The skinks collected in the course of our research in Madagascar can be roughly included in two categories in terms of ecological adaptability and, therefore, of conservation. The first group includes some of the *Mabuya* species, e.g. *Mabuya boettgeri, M. elegans* and *M. gravenhorstii* and some *Amphiglossus melanopleura* populations. These species can occur, sometimes in large numbers, in altered or slightly disturbed habitats. Some of the *Mabuya* species are able to colonize habitats altered by humans, especially open areas, such as road borders, 'slash and burn' agricultural areas ('tavy') and even green areas within villages and towns. Although some *Mabuya* species are restricted to small areas, in general they show a good colonizing capacity. This is evident for example, in *M. comorensis* which was able to colonize and proliferate at Nosy Tanikely, a small offshore island next to Nosy Be. Specific conservation considerations regarding the genus *Mabuya* should therefore be addressed to the recently described species, the adaptability of which is not yet known, e.g. *Mabuya tandrefana* and *M. volamenaloha* (see Nussbaum, Raxworthy & Ramanamanjato, 1999). *Amphiglossus melanopleura* is also a species that is very common in many of the surveyed rainforests of Madagascar. At Andohahela, in what is the southernmost 'tropical' rainforest in the world, the species is particularly common and abundant, even during the dry season (Andreone & Randriamahazo, 1997; Nussbaum, Raxworthy *et al.*, 1999). However, we also often found *A. melanopleura* in degraded habitats adjacent to rainforests, such as at Andasibe and Ranomafana (Andreone, 1991). Another species which appears to be extremely adaptable and little affected by human influence is *Cryptoblepharus voeltzkowi.* Indeed, in that the species can use constructed breakwaters (C. Domerque, in Brygoo, 1986), it may actually benefit from human activity in some areas.

The second group of species includes those that are typical of largely pristine rainforests or still largely unaltered large forest blocks. This group includes most of the remaining *Amphiglossus, Paracontias* and *Pseudoacontias* species. Of the described new species, six (*Amphiglossus mandady, A. nanus, A. spilostichus, A. stylus, Paracontias hafa* and *P. tsararano*) come from north-east Madagascar, which is an area particularly interesting in terms of biological diversity and ecological conditions (Andreone, Randrianirina *et al.*, 2000). One species, *Paracontias hafa* n. sp. was found on the western slope of Anjanaharibe-Sud Massif. This site has previously produced other interesting taxa, such as a new colubrid snake of the genus *Pseudoxyrhopus* (*P. analabe*; Nussbaum, Andreone *et al.*, 1998) and the snake *Brygophis coulangesi* (until recently known only from the holotype). This area is currently subject to conservation efforts and is likely to be included within the RS d'Anjanaharibe-Sud boundaries. This should provide for a certain degree of protection for the habitats and animals found there, including the new *Paracontias*.

On the other hand, the species *Paracontias tsararano* n. sp. was found at Tsararano Forest, which is currently not protected in any way. Therefore, this forest is under the risk of slash and burn agriculture and other kinds of exploitation. However, we stress that this forest is of critical importance in the conservation of forests in Madagascar, since it is one of the forests which connect the large forest complex of Tsaratanana–Marojejy–Anjanaharibe with the huge Masoala Forest (Andreone, Randrianirina *et al.*, 2000). It is therefore hoped that, as is likely, *P. tsararano* will be found at other low altitude rainforests south of Tsararano. This is also the case of the peculiar *Amphiglossus stylus* n. sp., which was found at Menamalona Forest, Masoala. This forest is a few metres outside the PN de Masoala boundaries, lying along the narrow Ilampy Corridor, and therefore it is not protected in a strict sense. However, it is likely that some protection of this habitat will arise from its proximity to the large forest parcels of Masoala. Furthermore, it is very likely that *A. stylus* lives within the park. However, further surveys will be needed to ascertain its presence.

*Pseudoacontias menamainty* n. sp., comes from Berara Forest, Sahamalaza Peninsula, in the north-west of Madagascar. The forest where this skink was found is extremely interesting due to the mixture of western and Sambirano elements which characterize it (Andreone, Mattioli *et al.*, 2001). The Berara Forest is also extremely interesting in terms of skink diversity, since we found other little known species, such as *Amphiglossus stumpffi, A. reticulatus* and *A. elongatus.* Although the inner forests of Sahamalaza are much fragmented, it is probable that they will be protected in the near future because of the variety of ecosystems and the large population of *Eulemur macaco flavifrons* (M. Hatchwell, J.-M. Lernould & Y. Rumpler, pers. comm.).

Although detailed studies have yet to be done, it seems likely that many of the fossorial or semi-fossorial skink species of Madagascar are likely to suffer from the reduction and elimination of the leaf litter that almost inevitably accompanies deforestation. It is known that many terrestrial and scansorial frogs also suffer from this change (e.g. Andreone, 1994), and it is likely that litter-living skinks are affected in the same way.

Finally, the discovery of nine new species of skinks stresses once more how incomplete is the knowledge of the Malagasy herpetofauna. Further surveys are therefore needed to understand the diversity of the small forest skinks and to provide data to evaluate properly the conservation status of many forests of Madagascar.

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## APPENDIX 1

List of specimens housed in Museo Regionale di Scienze Naturale

### Abbreviations

Localities: AB = Ambovombe, Ambovombe Fivondronana, Toliara Faritany (Tuléar Province); A1 = Ambolokopatrika Forest, Campsite 1 (Andemakatsara), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°31.8′S, 49°26.5′E; A2 = Ambolokopatrika Forest, Campsite 2 (Andranomadio), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°32.4′S, 49°26.3′E; AI = Ambariobe Islet, Andoany Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 13°26′S, 48°22′E; AM = Ankaratra Massif, Manjakatompo, Ambatolampy Fivondronana, Antananarivo Faritany (Tananarive Province), 19°21′S, 47°18′E; AS = Antsirasira, Ambanja Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 13°56.37′S, 48°33.27′E; BF = Berara Forest, Sahamalaza Peninsula, Analalava Fivondronana, Mahajanga Faritany (Majunga Province), 14°18.55′S, 47°54.92′E; B1 = Besariaka Forest, Campsite 1 (Ambinaninimiakamidina), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°50.8′S, 49°35.7′E; B2 = Besariaka Forest, Campsite 2 (Ambinanin'antsahamaloto), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°49.65′S, 49°35.73′E; F = Fianarantsoa, Fianarantsoa Faritany (Province), 21°26′S, 45°05′E; FD = Tolagnaro (Fort Dauphin), Lebanona Beach, Tolagnaro Fivondronana, Toliara Faritany (Tuléar Province), 25°02′S, 47°00' E; I = Ifaty, Toliara (Tuléar) Fivondronana, Toliara Faritany (Tuléar Province), 23°09′S, 43°37′E; L = RNI de Lokobe, Nosy Be Island, Andoany (Hellville) Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 13°25′S, 48°20′E; M1 = Masoala Peninsula, Campsite1 (Ambatoledama), 15°17.00′S, 50°01.3′E, Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province); M2 = Masoala Peninsula, Campsite 2 (Beanjada), 15°16′S, 49°59′E, Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province); M3 = Masoala Peninsula, Campsite 3 (Andasin'i Governera), 15°18′S, 50°01′E, Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province); M4 = Masoala Peninsula, Campsite 4 (Antsarahan'Ambararato), 15°23.52′S, 50°02.82′E, Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province); M5 = Masoala Peninsula, Campsite 5 (Menamalona), Antalaha Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 15°22.87′S, 49°59.27′E; N = Nahampoana Forest, Tolagnaro Fivondronana, Toliara Faritany (Tuléar Province), 24°58′S, 46°58′E; NT = Nosy Tanikely, 13°28.96′S, 48°14.25′E, Andoany Fivondronana, Antsiranana Faritany (Diégo Suarez Province); PNA = PN de Andohahela, forest between Isaka Ivondro and Eminiminy, Isaka Ivondro Fivondronana, Toliara Faritany (Tuléar Province), 24°45′S, 46°51′E; PNI = PN d'Isalo, Ranohira, Fianarantsoa Faritany (Fianarantsoa Province), 22°22′S, 45°11′E; R = PN de Ranomafana, 21°17′S, 47°26′E, Ifanadiana Fivondronana, Fianarantsoa Faritany (Fianarantsoa Province); NM = RS de Nosy Mangabe, Maroantsetra Fivondronana, Toamasina Faritany (Tamatave Province), 15°30′S, 49°46′E; RSA = RS d'Analamazoatra, 18°56′S, 48°25′E, Fivondronana Moramanga, Toamasina (Tamatave) Faritany (Province); SM = Sainte Marie Island (Nosy Boraha), Toamasina Faritany (Tamatave Province), 17°00′S, 49°51′E; T1 = Tsararano Forest, Campsite 1 (Antsarahan'ny Tsararano), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.4′S, 49°41.2′E; T2 = Tsararano Forest, Campsite 2 (Andatony Anivo), Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.8′S, 49°42.6′E; TS = Manarikoba Forest, Antsahamanara, RNI de Tsaratanana, Marovato Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°02.55S', 48°46.79′E; AK = 'Valle dell'Umbi', Andrangoloaka, Moramanga Fivondronana, Toamasina Faritany (Tamatave Province), 47°55′E, 19°02′S; W1 = Anjanaharibe-Sud Massif, Analabe Valley, Campsite W1, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46′S, 49°27′E; W2 = Anjanaharibe-Sud Massif, Analabe Valley, Campsite W2, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46′S, 49°26′E. Collectors and donors: DV = D. Vallan; FA = F. Andreone; FM = F. Mattioli; GA = G. Aprea; HR = H. Randriamahazo; JER = J. E. Randrianirina; MGP = M. G. Peracca; MV = M. Vences; RN = R. Nincheri; SDM = S. De Michelis.

*Amphiglossus anosyensis* Raxworthy & Nussbaum, 1993

MRSN R1146, N, about 300 m, FA & RN, 14.IV. 1990.

*Amphiglossus astrolabi* Duméril and Bibron, 1839

MRSN R1143, FA, XI.1992; MRSN R1622, T2, FA, JER, 10.XII.1996; MRSN R1727, M5, 780 m, FA, JER, 18.XII.1999.

*Amphiglossus crenni* (Mocquard, 1906)

MRSN R1801, W1, 1000 m, FA, HR, JER, 2.II.1996; MRSN R1709, R1713, M4, 510 m, FA, JER, 5.XII.1999; MRSN R1733, B1, 965 m, FA, JER, 12.VI.1996; MRSN R1734, A2, 870m, FA, GA, JER, 7.XII.1997; MRSN R1735, A2, 870 m, FA, GA, JER, 8.XII.1997.

*Amphiglossus gastrostictus* (O'Shaughnessy, 1879)

MRSN R1705.1–2, W1, 1000 m, FA, HR, JER, 5.I.1996; MZUT R2202, AK, about 1386 m, MGP don.

*Amphiglossus macrocercus* (Günther, 1882)

MRSN R1775–1781, AM, about 1700 m, FA, SDM, JER, 11.I.1999. MZUT R2200.1–2, AK, 1386 m, 1893. MZUT R2871, without data.

*Amphiglossus melanopleura* (Günther, 1877)

MRSN R1036, without data; MRSN R1748, A1, 850 m, FA, JER, 29.V.1997; MRSN R1749, A2, 870 m, FA, JER, 9.VI.1997; MRSN R1750–1751, A1, 850 m, FA, GA, JER, 1.XII.1997; MRSN R1752, A1, 860 m, FA, GA, JER, 2.XII.1997; MRSN R1741, T1, 700 m, FA, JER, 1.XII.1996; MRSN R1742, T1, 700 m, FA, JER, 1.XII.1996; MRSN R1743, T1, 700 m, FA, JER, 1.XII.1996; MRSN R1744, T1, 700 m, FA, JER, 3.XII.1996; MRSN R1745, T1, 700 m, FA, JER, 4.XII.1996; MRSN R1746, T1, 700–850 m, FA, JER, 5.XII.1996; MRSN R1747, T1, 700 m, FA, JER, 6.XII.1996; MRSN R1706, M4, 520 m, leg FA, JER, 3.XII.1999; MRSN R1707–1708, M4, 520 m, FA, JER, 4.XII.1999; MRSN R1710–1711, M4, 530 m, FA, JER, 5.XII.1999; MRSN R1800, M4, 510 m, FA, JER, 5.XII.1999; MRSN R1188, NM, 5 m, FA, 5.VIII.1988; MRSN R1181, RSA, 900 m, FA, RN, 2.V.1990; MRSN R1147.1–3, PNA, 600 m, FA, DV, 5–18.XI.1994; MRSN R1196.1–3, PNA, 600 m, FA, HR, 17.IV–4.V.1994; MRSN R1827, M5, 780 m, FA, JER, 13.XII.1999. MRSN R1828, M5, 780 m, FA, JER, 14.XII.1999; MRSN R1854, M1, 450 m, FA, JER, 15.XI.1998; MRSN R1855, M2, 620 m, FA, JER, 27.XI.1998; MRSN R1856, M2, 620 m, FA, JER, 28.XI.1998; MRSN R1857, M3, 650 m, FA, JER, 5.XII.1998; MRSN R1858–1859, M3, 650 m, FA, JER, 6.XII.1998 MRSN R1860, M3, 650 m, FA, JER, 8.XII.1998; MRSN R1861, TS, about 1100 m, FA, FM, JER, MV, 4.II.2001; MRSN R1862–1863, TS, about 1100 m, FA, FM, JER, MV, 7.II.2001.

*Amphiglossus melanurus* (Günther, 1877)

MRSN R1792, W2, 1400 m, FA, HR, JER, 8.II.1996; MRSN R1753, T1, 800 m, FA, JER, 8.XII.1996; MRSN R1864, M3, 650 m, FA, JER, 7.XII.1998

*Amphiglossus mouroundavae* (Grandidier, 1872)

MRSN R1763, T2, 650 m,FA, JER, 17.XII.1996; MRSN R1764, A1, 810 m, FA, GA, JER, 2.XII.1997; MRSN R1765, A1, 810 m, FA, GA, JER, 3.XII.1997; MRSN R1766–1767, A2, 870 m, FA, GA, JER, 11.XII.1997; MRSN R1768, A2, 870 m, FA, GA, JER, 13.XII.1997; MRSN R1769–1770, A2, 860 m, FA, GA, JER, 14.XII.1997; MRSN R1771–1773, A2, 880 m, FA, GA, JER, 16.XII.1997; MRSN R1754, T1, 700 m, FA, JER, 29.XI.1996; MRSN R1755–1762 (FN 6452), T2, 750 m, FA, JER, 12.XII.1996. MRSN R1807 (ANJ 07), W1, 1000 m, FA, HR, JER, 28.I.1996; MRSN R1866, TS, about 1100 m, FA, FM, JER, MV 7.II.2001; MRSN R1867, TS, about 1100 m, FA, FM, JER, MV 10.II.2001; MRSN R1868–1869, TS, about 1100 m, FA, FM, JER, MV 11.II.2001.

*Amphiglossus ornaticeps* (Boulenger, 1896)

MRSN R1148, PNA, 600 m, FA, DV, 9.XI.1994.

*Amphiglossus praeornatus* (Angel, 1938)

MRSN R1736, T2, 650 m, FA, JER, 12.XII.1996; MRSN R1712, M4, 510 m, FA, JER, 7.XII.1999; MRSN R1714, M5, 780 m, FA, JER, 12.XII.1999; MRSN R1715, M5, 780 m, FA, JER, 14.XII.1999; MRSN R1716, M5, 790 m, FA, JER, 16.XII.1999; MRSN R1851–1852, M2, 620 m, FA, JER, 28.XI.1998; MRSN R1853, M3, 650 m, FA, JER, 6.XII.1998.

*Amphiglossus punctatus* (Nussbaum & Raxworthy, 1993)

MRSN R1808, W1, 1100 m, FA, HR, JER, 8.II.1996; MRSN R1774, T1, 700 m, FA, JER, 2.XII.1996.

*Amphiglossus reticulatus* (Kaudern, 1922)

MRSN R1720–1721, BF, 180 m, FA, JER, MV, 15.II.2000; MRSN R1723, BF, 175 m, FA, JER, MV, 17.II.2000; MRSN R1728, BF, 170 m, FA, JER, MV, 21.II.2000.

*Amphiglossus splendidus* (A. Grandidier, 1872)

MZUT R2201, F.

*Amphiglossus stumpffi* (Boettger, 1882)

MRSN R1718, BF, 180 m, FA, JER, MV, 14.II.2000; MRSN R1719, BF, 170 m, FA, JER, MV, 16.II.2000; MRSN R1722, BF, 190 m, FA, JER, MV, 17.II.2000; MRSN R1724, BF, 190 m, FA, JER, MV, 18.II.2000; MRSN R1726, BF, 175 m, FA, JER, MV, 21.II.2000; MRSN R1873, AS, about 75 m, FA, FM, JER, MV, 30.I.2001.

*Cryptoblepharus cognatus* (Boettger, 1881)

MRSN R1788–1791, AI, 0 m, FA, JER, 14.II.1999; MRSN R1874, L, 1 m, FA, JER, 16.III.2000.

*Cryptoblepharus voeltzkowi* (Sternfeld, 1918)

MRSN R1809–1814, FD, 0 m, FA, GA, 30.XII.1997; MZUT R1159.1–2, I, 0–1 m, leg FA, 11.V.1994.

*Mabuya aureopunctata* A. Grandidier, 1867

MRSN R1815, AB, FA, GA, 27.XII.1997.

*Mabuya boettgeri* Boulenger, 1887

MRSN R1782–1784, AM, about 1700 m, FA, SDM, JER, 9.I.1999; MZUT R426, AK, about 1386 m; MRSN R1875, AM, FA, SDM, JER, 10.I.1999; MRSN R 1883–1884, AM, about 1700 m, JER, 3–10.X.1998.

*Mabuya comorensis* (Peters, 1854)

MRSN R1731, R1793–1796, NT, FA, JER, 16.III.2000.

*Mabuya elegans* (Peters, 1854)

MRSN R1730, path between Berara Forest and Betsimipoaka Village, FA, about 100 m, JER, MV 23.II.2000; MRSN R1173, PNI, 550 m, FA, 15.V.1994; MRSN R1816, AB, FA, GA, XII.1997; MRSN R1817, FD, 0 m, FA, GA, XII.1997.

*Mabuya gravenhorstii* Duméril & Bibron, 1839

MRSN R1725, BF, 170 m, FA, JER, MV, 20.II.2000; MRSN R1820, MRSN R1826–1827, B2, 850 m, VI.1996; MRSN R1821, B2, 850 m, VI.1996; MRSN R1823, R FA, GA, 4.I.1998; MRSN R1824, R, FA, GA, 4.I.1998; MRSN R1822, I, 3 m, FA, GA, 30.XII.1997; MRSN R1818, F, 750 m, FA, GA, 3. I.1998; MRSN R1819, I, 4 m, FA, GA, 1. I. 1998.; MRSN R1151, PNA, 600 m, FA, DV, 14.XI.1994. MRSN R1194.1–2, N, about 300 m, FA, RN, 14.IV.1990. MZUT R434, AK, about 1386 m, MGP don.; MRSN R1876, SM, < 50 m, FA, VI.1995; MRSN R1877, L, 0–5 m, FA, JER, 8.II.1999; MRSN R1878, L, 0–5 m, FA, JER, 10.II.1999; MRSN R1879, L, 0–5 m, FA & JER, 14.II.1999; MRSN R1880, L, 0–5 m, FA & JER, 15.II.1999; MRSN R1881, L, 0–5 m, FA & JER, 18.II.1999; MRSN R 1882, AS, < 20 m, FA, FM, JER, MV, 31.I.2001.

*Mabuya madagascariensis* Mocquard, 1908

MRSN R1785, AM, about 1700 m, FA, SDM, JER, 09.I.1999; MRSN R1885–1886, AM, about 1700 m, JER, 3–10.X.1998.

*Paracontias hildebrandti* (Peters, 1880)

MZUT R3424 Madagascar, 10.X.1888.

*Paracontias holomelas* (Günther, 1877)

MRSN R1786, M1, 450 m, FA, JER, 18.XI.1998.

## APPENDIX 2

Historical remarks on specimens from the Museum of Zoology in Turin University

The Malagasy skink specimens reported in this paper under the acronym MZUT were obtained and donated to the former Museum of Zoology of the Turin University (collection now held at MRSN) by M.G. Peracca, the then curator and assistant of herpetology.

Peracca was an eminent Turinese herpetologist active at the end of the 19th century and at the beginning of 20th (born in 1861, he died in 1923; Andreone & Gavetti, 1999). He studied amphibians and reptiles from a number of regions but especially Latin America, Italy and mainland Africa. As was common at that time, he did not go into the field but obtained specimens (by exchange or purchase) from colleagues, dealers and other naturalists. Certainly, this was the origin of several new taxa of Malagasy amphibians and reptiles that he described in two papers in 1892 and 1893 (Peracca, 1892, 1893), among which were *Mantidactylus alutus, M. aerumnalis, M. opiparis, Liopholidophis dolichocercus* and *Geodipsas boulengeri*. The collecting locality for most of these animals was given as 'Andrangoloka, Valle dell'Umbi' (see also Cadle, 1996*a*,*b*). However, the collector was never given, either in the published papers or in the handwritten catalogues and labels accompanying the specimens, and it was probably not considered important by Peracca. At the time, Andrangoloka (or Andrangoloaka, as subsequently reported) was almost certainly a small village next to Mantasoa, on the high plateau, between Antananarivo and Moramanga. Now this name refers to a forest area placed next to Mantasoa Lake, an artificial lake created in the 1930s. At the time of Peracca, the site was at least partly covered by a typical plateau rainforest, of which there are now only a few remnants. According to Cadle (1996*a*,*b*) the site co-ordinates are 19°02′S, 47°5′E (Moramanga Fivondronana, Toamasina Faritany). Recently (January 2000), F. Andreone visited the area (at 19°01.42′S, 47°55.59′E) and found that a very small portion of the Andrangoloaka Forest still exists, although much reduced. The Andrangoloaka Forest is a typical residual high plateau forest, likely in continuity (or recently separated) with the large Mandraka Forest.

Although we cannot be certain, it is likely that the skink specimens were obtained from different sources. However, based on other specimens coming from Madagascar at that time (e.g. a crab: Nobili, 1905), it is likely that the main collector (or dealer) was Mr L. Pittarelli (see also Cadle, 1996*a*,*b*). This man was probably a missionary based at Moramanga or a nearby locality. From that town it was relatively easy to collect animals at Andrangoloaka. Another possibility that cannot be discounted is that some of the animals were collected by J. M. Hildebrandt who, during his travels in Madagascar in 1880, visited Andrangoloaka (Beentje, 1998).

The collections of specimens published by Peracca were made at 'Valle dell'Umbi'. This suggests that the location was in the valley of the Umbi River. 'Umbi' does not now appear on any maps, but it is worth noting that 'omby' in Malagasy means 'ox' or 'beef'. Therefore, it is possible that the name 'Umbi' applied to an area where cattle (zebus) were bred.

The total number of shipments of Malagasy specimens that Peracca (and the Museum of Zoology in Turin) received is unclear, but there seems to have been at least three. These included not only amphibians and reptiles but also invertebrates and a few mammals, such as the lipotyphlan *Tenrec ecaudatus*; F. Andreone, unpubl.). The specimens that arrived in 1892 and 1893 were the subject of the two published papers mentioned above. But according to letters from Peracca to G. A. Boulenger and still archived at London, at least one further batch of Malagasy specimens arrived in late 1893, but these specimens were never the subject of a publication. The MZUT skinks currently housed in the Museo Regionale di Scienze Naturali in Turin (*Amphiglossus gastrostictus* MZUT R2202, *A. macrocercus* MZUT R2200.1–2 and R2871, *A. splendidus* MZUT R2201, *Mabuya boettgeri* MZUT R426, *M. gravenhorstii* MZUT R434, *Paracontias hildebrandti* MZUT R3424) are probably referable to this last group of specimens, because they were not quoted in any of Peracca's publications.