

## Description of a new *Geodipsas* snake from northern Madagascar (Squamata: Colubridae)

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### Abstract

We describe a new species of the colubrid snake genus *Geodipsas* from the rainforests of the Anjanaharibe-Sud and Tsaratanana massifs, northern Madagascar. *Geodipsas fatsibe* n. sp. differs from the other described species of the genus in the following characteristics: 21 rows of dorsal scales at midbody, high number of ventral (198) scales and by the presence of very large hooked spines on the hemipenis. *Geodipsas fatsibe* is most similar to *Geodipsas infralineata*. Most likely they are sister species, with a vicariant northern vs. central southern distribution.

**Key words:** *Geodipsas*; Colubridae; new species; Madagascar

### Introduction

The colubrid snake genus *Geodipsas* Boulenger was before a recent taxonomical change the only genus shared between Africa mainland and Madagascar. Cadle (1996) in his review of the genus *Geodipsas* recognised five Malagasy species: *G. zeny* Cadle, *G. boulengeri* (Peracca), *G. vinckei* Domergue, *G. infralineata* (Günther), and *G. laphystia* Cadle. Moreover, he also quoted a possible sixth (still undescribed) species (*G.* “species inquirenda”) from Montagne d’Ambre (Raxworthy & Nussbaum, 1994). The species from mainland Africa, and formerly ascribed to the genus *Geodipsas*, were moved to the distinct genus *Buhoma* on the basis of the deeply bifurcate *sulcus spermaticus* (Ziegler et al., 1997): *B. depressiceps* (Werner), *B. procterae* (Loveridge) and *B. vauerocegae* (Tornier). Therefore, the species belonging to *Geodipsas* genus are today endemic and restricted to Madagascar.

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The five currently recognised *Geodipsas* species inhabit middle and high altitude rainforests of eastern Madagascar, and they all show mainly nocturnal habits. *Geodipsas laphystia* is arboreal, while *G. infralineata* leads a rather terrestrial life, although it can also climb trees. *Geodipsas zeny*, *G. boulengeri* and *G. vinckei* are terrestrial, with secretive and still mostly unknown habits. *Geodipsas vinckei* is known from the type specimen only, but the body shape described as cylindrical with a head poorly distinct from the neck (Domergue, 1988), and the short tail suggests terrestrial habits. A part this, virtually very little is known about the ecology and life history of the various *Geodipsas* species beside the information provided by Cadle (1996), and some data given by Andreone & Luiselli (2000).

During our ongoing cataloguing of the snake collection housed in Turin Museum we analysed some specimens recently collected by one of us (FA) and preliminarily attributed to *G. infralineata* (see Raxworthy et al., 1998), but with unusual meristic and morphological features. Because the specimens differ in several relevant characters from all others species of *Geodipsas* hitherto known, we recognise them as belonging a new species that is here described.

## Material and Methods

The snakes were collected at night by opportunistic searches. Voucher specimens were euthanized by injection with chlorobutanol solution or exposure to ether, fixed in 4% buffered formalin and transferred to 70–75% ethanol. The material belongs to the herpetological collection housed in Museo Regionale di Scienze Naturali, Turin (MRSN).

The specimens were studied under stereomicroscope magnification, and the metric measurements were taken with a ruler to the nearest 0.1 mm. Hemipenial extraction followed partially Pesantes (1994). Hemipenial terminology follows Dowling & Savage (1960). Furthermore, we drawn the morphology of the hemipenes by tracing pictures obtained from slides and digital photographs in order to maintain the actual proportions.

## Results

### *Description of Geodipsas fatsibe n. sp.*

(Figs 1–3)

*Holotype*—MRSN R1922, an adult male in good state of preservation, collected on 28 January 1996, western slope of Anjanaharibe-Sud Massif, Valley of Analabe River, 14°46.62'S, 49°26.60'E, 1050 m a.s.l., Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), Madagascar, by F. Andreone, H. Randriamahazo, and J. E. Randrianirina.

*Paratypes*—MRSN R1921, an adult male in good state of preservation with slightly truncated tail, date of collecting and provenience as for the holotype; MRSN R1920, an adult male in good state of preservation with partially everted hemipenis, collected on 3 February 2001, eastern slope of Tsaratanana Massif, Antsahamanara, 14°02.55'S, 48°46.79'E, Marovato Fivondronana, Antsiranana Faritany (Diégo Suarez Province), by F. Andreone, F. Mattioli, J.E. Randrianirina, and M. Vences.

*Diagnosis*—The only *Geodipsas* species with 21 rows of dorsal scales at midbody and a high number of ventrals (195–198).



**FIGURE 1.** Living holotype of *Geodipsas fatsibe* n. sp., from Analabe Valley, Anjanaharibe-Sud Massif, north-eastern Madagascar (MRSN R1922).



**FIGURE 2.** Living paratype of *Geodipsas fatsibe* n. sp., from Antsahamanara, Tsaratanana Massif, northern Madagascar (MRSN R1920).

*Description of the holotype*—Total length 522 mm; tail 127 mm; 21-21-19 rows of smooth dorsal scales at forebody, midbody and precloacal zone respectively; body rather compressed laterally, more high than wide; 198 ventral scales; 78 divided subcaudals;

cloacal plate undivided; 7 supralabials, 3<sup>rd</sup> and 4<sup>th</sup> in contact with the eye; 9 infralabials, 4 in contact with the anterior genials; anterior genial barely longer than posterior genials; rostral wider than high, visible from above; loreal trapezoidal; one preocular, two postoculars; temporals 1 + 2 + 3 rows; eye vertical diameter 3.2 mm; pupil circular; head distinct from the neck. Measurements and scale characters are summarized in Table 1.

**TABLE 1.** Morphometric and meristic characters of *Geodipsas fatsibe* n. sp. Measurements given in mm. Paired values separated by a slash indicate left and right measurements.

Character	MRSN R1922	MRSN R1921	MRSN R1920
Status	Holotype	Paratype	Paratype
Sex	Male	Male	Male
Provenance	Anjanaharibe-Sud	Anjanaharibe-Sud	Tsaratana
Snout vent length	395	427	485
Tail length	127	35*	135
Head width	9.4	9.5	9.9
Head length	10.2	11.2	12.7
Neck width	5.0	5.2	5.8
Eyes diameter	3.0	3.0	3.3
Distance eye tip of snout	4.4	4.7	4.9
Dorsal scale rows	21-21-19	21-21-19	21-21-19
Ventral scales	198	195	197
Subcaudal scales	78	19*	82
Preocular scales	1/1	1/1	1/1
Postocular scales	2/2	2/2	2/2
Scales surrounding eyes	6/6	6/6	6/6
Scales surrounding parietals	11/9	10/10	8/9
Loreal scale	1/1	1/1	1/1
Temporal scales	1-2-3	1-2-3	1-2-3
Supralabial scales	7/7	7/7	7/7
Infralabial scales	9/9	9/9	9/9
Anal plate	Divided	Divided	Divided

\* specimen with truncated tail. Values are therefore not significant for a comparison.

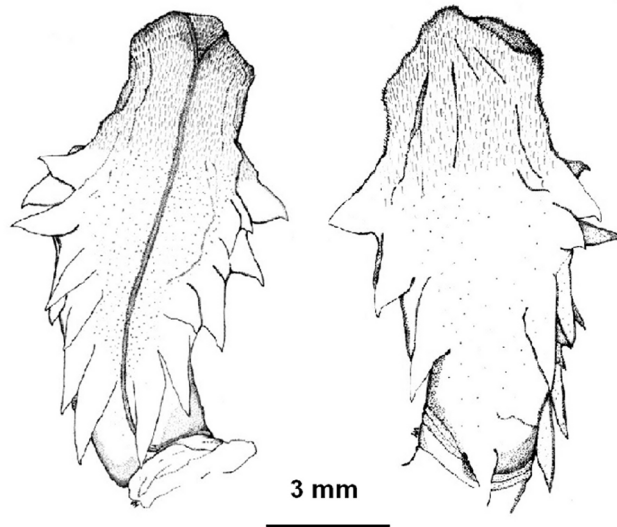
*Hemipenial morphology*—Fully everted hemipenis single, slightly clavate, noncapitate, and acalyculate. Everted organs little flexed (maybe due to the cut of the

major retractor muscle required for the extraction), total length of approximately 14.0 mm. *Sulcus spermaticus* centrolineal forked distally, represented by a deep furrow bifurcated for about 2.0 mm of its total length of approximately 12.6 mm. Undifferentiated ornamentation with proximal area naked and distal area covered with minute spines tidily arranged around the sulcus forks, lack of irregular surface texture; in sulcal view composed of two large basal hooks on either side of the *sulcus spermaticus* symmetrically arranged followed by four very strong, elongate and hooked spines in the left and right side; in asulcal view composed by one centred large basal spine followed by three pairs of very large spine, one for each side.

*Colouration*—In the holotype the scale borders outlined in black, often forming narrow chevrons that draw dark somehow appears as diagonal lines on the flanks or a irregular network. In the posterior part of the body a black vertebral line, from midbody to the tail tip is present. The head shows a typical pattern, on the ground colour a more or less distinct stripe is present between the suture of the parietals on the superior margin of the prefrontals, internasals and rostral and on the one of the posterior supralabials. These stripes are formed through the union of the black margin of the scales of the head. Furthermore, there are many dark flecks that occur to create a spotted pattern. A black band on the neck is also present. In contrast to this dark colouration the supralabials are yellowish to white and separated from each other by a dark line. Lower labials and throat creamy white to yellow. Ventral colour whitish to yellow, more or less pigmented by small brown flecks that posteriorly former a more or less distinct narrow midventral stripe. Subcaudals white, with a dark mid-ventral line. After 4–9 years the analysed specimens maintained the overall natural colour pattern, although they showed a general body shrinkage and slight loss of colour.

*Variation*—The three specimens are similar in general aspect, and share similarities in size, lepidosis and body proportions (Table 1). However, they show polychromy in the dorsolateral background colour, with the two individuals from Anjanaharibe-Sud being purple greyish and the one from Tsaratanana light brownish. The paratype MRSN R1921 is a mature male with a dorsolateral purple greyish colour, with an irregular network of dark diagonal stripes (especially on the posterior part of the body), and a black vertebral line. Ventral colour whitish anteriorly immaculate pigmented by small brown flecks that posteriorly form a distinct narrow midventral stripe. The paratype MRSN R1920, from Tsaratanana, has a light brownish dorsolateral ground colour with a quite regular network of dark diagonal stripes from head to the tail and with a black vertebral line posteriorly. Belly anteriorly yellowish, with small brown flecks that increase in number posteriorly towards the vent; subcaudals whitish with dark brownish midventral line.

*Etymology*—The specific name “fatsibe” is a Malagasy name, composed by two words: “fatsy”, meaning spine, and the suffix “be”, meaning “big” or “large sized”. The specific epithet (pronounced *fow-tsee-bay*) makes reference to the large hooked spines at the base of the hemipenis. It is used as a noun in apposition.



**FIGURE 3.** Everted hemipenis of *Geodipsas fatsibe* n. sp. (from the holotype MRSN R1922). Left sulcal side, right: asulcal side.

*Distribution*—So far the species is known only from the Anjanaharibe-Sud Massif and the Tsaratanana Massif. We suspect that it might be present in other northern rainforest areas, such as Marojejy, Ambolokopatrika, and Masoala.

*Habitats and habits*—The three specimens were found at night, while climbing small trees, at about 1.5–2.0 m of elevation from the ground.

*Justification*—*Geodipsas fatsibe* can be distinguished from all the species hitherto known, because it is the only of the genus with 21 rows of dorsal scales at midbody and for other diagnostic lepidosis characters (Table 2). Unfortunately, the small number of available specimens and the presence of only males in the series do not allow an exhaustive comparison with the other *Geodipsas* species. In terms of pattern of dorsolateral colouration and overall aspect *G. fatsibe* could be confused with *G. laphystia* and with *G. infralineata*. However, *G. fatsibe* differs from *G. infralineata*, by having more ventrals (195–198 vs 172–193 in males) and subcaudals (78–82 vs 53–77 in males), smaller body size (620 vs 783 mm maximum known length in males). *Geodipsas fatsibe* is also distinguished from *G. infralineata* by having a body laterally more compressed, head more distinct from the neck (1.8 vs 1.3 ratio head width / neck width in specimens of equivalent dimensions), a darker network on the upper side of the head (vs presence only along the interparietal suture), and a comparatively shorter snout (4.7 vs 7.0 mm in specimens of similar size). Remarkable differences lie in the hemipenial ornamentation with the presence on the sulcal side in *G. fatsibe* of elongate and hooked spines (vs. smaller hooked spines). *Geodipsas fatsibe* is distinguished from *G. laphystia* by general lepidosis characters, by having dorsum with a irregular network of dark diagonal stripes (vs. longitudinal fine dark lines), and by characters of hemipenial morphology.

**TABLE 2.** Comparative morphometric and meristic data of *Geodipsas* species.

<i>Geodipsas</i> species	SVL	TL	DS	VS	SS
<i>G. fatsibe</i> n.sp.	485	135	21-21-19	195-198	78-82
<i>G. boulengeri</i>	298	55	19-19-17	131-137	24-36
<i>G. infralineata</i>	635	148	19-19-17	172-193	53-77
<i>G.</i> “species inquirenda”	?	?	19-19-17	143-150	?
<i>G. laphystia</i>	469	153	19-19-17	180-187	70-81
<i>G. vinckei</i>	411	84	21-19-17	163	45
<i>G. zeny</i>	228	53	19-19-17	135-137	41

Used abbreviations: SVL: maximum snout vent length in mm; TL: maximum tail length in mm; DS: number of dorsal scale rows counted at forebody, midbody and precloacal zone; VS: number of ventral scale; SS number of subcaudal scales. Data are given only for males. Question marks indicate the missing data for a still undescribed species.

## Discussion

The monophyly of the genus *Geodipsas* is strongly supported by some hemipenial characters, including: simple organs, distal division of the *sulcus spermaticus* and general similarity of ornamentation. Moreover at generic level the species can be differentiated in two groups on the basis of lepidosis, hemipenis characters and arboreal or terrestrial habits (Cadle, 1996). In fact, as underlined by Cadle (1996) although the general hemipenial morphology of all *Geodipsas* species appears to be similar there are some distinctive differences in the number, dimension and arrangement of the some spines.

In detail, *G. fatsibe* shares with *G. infralineata* and *G. laphystia* some characters associated with arboreality (e.g., compressed body, long prehensile tail, head distinct from the neck), high numbers of ventral and subcaudals and, variability in the dorsal colouration. Furthermore, the major similarities between *G. fatsibe* and *G. infralineata* include the presence in the sulcal and asulcal sides of enlarged hooked spines arranged in rows, organ distally covered by spinules and very short branches of the *sulcus spermaticus*. Besides, in having only one enlarged basal spines on the asulcal side *G. fatsibe* and *G. infralineata* differ from those of *laphystia*, *boulengeri* and *zeny*, which have two spines.

A possible further character is the odd strongly flexed hemipenis of *G. infralineata*. Interestingly, the hemipenis of *infralineata* drawn in Ziegler (1997) and everted from preserved specimen with the Pesantes method are not flexed. In contrast the organs of the same species drawn in Cadle (1996) prepared from fresh specimen are strongly curved. Our personal observation of fresh full everted organs of *G. infralineata* confirm the presence of strongly flexed organs. The little flexion of the organ of *G. fatsibe* should be a preparation artefact due to the Pesantes method that forecast the cut of *musculus retractor*

*penis magnus*. For this reason we putatively suggest the presence in *G. fatsibe* of this character status.

In conclusion, this similarity in hemipenial morphology and ornamentation and dorsal colouration of *G. fatsibe* and *G. infralineata* underline that they may be closely related and likely represent vicariant species. The presence of *G. fatsibe* at Anjanaharibe-Sud and Tsaratanana suggests that it might be a taxon endemic to northern Madagascar, while *G. infralineata* is a species with a vicariant central-southern distribution.

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### Literature cited

- Andreone, F. & Luiselli, L. (2000) Are there shared patterns of specific diversity, abundance, and guild structure in snake communities of tropical forests of Madagascar and continental Africa? *Terre et Vie (Revue d'Ecologie)*, 55, 215–239.
- Cadle, J.E. (1996) Systematics of snakes of the genus *Geodipsas* (Colubridae) from Madagascar, with descriptions of new species and observations on natural history. *Bulletin of the Museum of Comparative Zoology*, 155(2), 33–87.
- Domergue, C.A. (1988) Notes sur les serpents de la région malgache VIII. Colubridae nouveaux. *Bulletin du Muséum national d'Histoire Naturelle*, ser. 4, 10, 135–146.
- Dowling, H.G. & Savage, J.M. (1960) A guide to snake hemipenis: a survey of basic structure and systematic characteristics. *Zoologica*, 45, 17–28.
- Pesantes, C.S. (1994) A method for preparing the hemipenis of preserved snakes. *Journal of Herpetology*, 28(1), 93–95.
- Raxworthy, C.J., Andreone, F., Nussbaum, R.A., Rabibisoa, N. & Randriamahazo, H. (1998) Amphibians and reptiles of the Anjanaharibe-Sud Massif, Madagascar: elevational distribution and regional endemism. In: A floral and faunal inventory of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar: with reference to elevational variation (S. M. Goodman ed.) pp. 79–92. *Fieldiana: Zoology*, n.s. 90, 1–246.
- Raxworthy, C.J. & Nussbaum, R.A. (1994) A rainforest survey of amphibians, reptiles and small mammals at Montagne d'Ambre, Madagascar. *Biological Conservation*, 69, 65–73.
- Ziegler, T., Vences, M., Glaw, F. & Böhme, W. (1997) Genital morphology and systematics of *Geodipsas* Boulenger, 1896 (Reptilia, Serpentes, Colubridae), with description of a new genus. *Revue Suisse de Zoologie*, 104(1), 95–114.