

## Review of the *Zonosaurus aeneus* species group, with resurrection of *Zonosaurus subunicolor* (BOETTGER 1881)

(Reptilia: Squamata: Gerrhosauridae)

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With 6 figures and 3 tables

### Abstract

A taxonomic revision of the *Zonosaurus* species with three supralabials anterior to the subocular (hitherto *Z. aeneus*, *Z. rufipes*, and *Z. brygooi*; here named *Z. aeneus* group) demonstrated the validity of the taxon *Gerrhosaurus rufipes* var. *subunicolor* BOETTGER 1881, which is resurrected as *Zonosaurus subunicolor*. This species occurs sympatrically with *Z. rufipes* and can be distinguished by various colouration characters, and by habitat preferences. *Z. subunicolor* can also be distinguished from the available material of *Zonosaurus brygooi* by having a lower number of femoral pores, a higher number of scales around midbody and lamellae under the fourth toe, and by the presence of a (small) interparietal scale.

*Z. aeneus* and *Z. brygooi* can be distinguished by colouration and by the conformation of the first supralabial scale posterior to the subocular, which is divided in *brygooi* and entire in *aeneus*. *Z. aeneus* has generally distinct and continuous light dorsolateral stripes, whereas these stripes are absent or reduced to an inconspicuous series of light spots in *Z. brygooi*. The latter species lives in the lowlands of the Malagasy east coast, whereas *Z. aeneus* is found in eastern mid-altitude localities. The type locality of *Z. brygooi*, Nosy Be in north-western Madagascar, lacks recent confirmation.

### Introduction

The rather large lizards of the genus *Zonosaurus* are endemic to the Malagasy region. Most species are restricted to Madagascar and its offshore islands; only *Z. madagascariensis* also occurs as subspecies *insulanus* on the Glorieuse and Cosmoledo islands (BRYGOO 1985a). Following the most recent revision (BRYGOO 1985a) the gerrhosaurid genus *Zonosaurus* BOULENGER 1887 contains 10 species: *Z. aeneus* (GRANDIDIER 1872), *Z. boettgeri* STEINDACHNER 1891, *Z. karsteni* (GRANDIDIER 1869), *Z. laticaudatus* (GRANDIDIER 1869), *Z. madagascariensis* (GRAY 1831), *Z. maximus* BOULENGER 1896, *Z. ornatus* (GRAY 1831), *Z. quadrilineatus* GRANDIDIER 1867, *Z. rufipes* (BOETTGER 1881), *Z. trilineatus* ANGEL 1939. An additional species, *Z. brygooi*, was described by LANG & BÖHME 1990, and one subspecies (*Z. madagascariensis havaldmeieri* BRYGOO

& BÖHME 1985) given specific rank as *Z. havaldmeieri* (MEIER 1989, LANG 1990, RAXWORTHY & NUSSBAUM 1994, GLAW & VENCES 1994).

Within *Zonosaurus* several species groups can be distinguished (LANG 1990, GLAW & VENCES 1994). *Z. trilineatus* and *Z. quadrilineatus* are very similar allopatric forms of southern Madagascar, whereas *Z. karsteni* and *Z. laticaudatus* occur sympatrically in western Madagascar. An additional group of related *Zonosaurus* species is characterized by the presence of generally three supralabials anterior to the subocular (a character shared with the genus *Tracheloptychus*), 2-3 well-defined mite pockets within the antehumeral fold (LANG & BÖHME 1990), and the relatively small size. This character combination is found in *Z. aeneus*, *Z. rufipes*, and *Z. brygooi* (LANG &

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Date/ Collection Nr.	Locality	Fem.Por	IP	SVL	TaL	Mid.Bod.	CH-CL	4.Toe
<i>Zonosaurus aeneus</i>								
MHNP* 7634	Malaimbandy?	14	-	32	53	20		20
MHNP 1965-312	Anosibe	16	-	65	(-)	20		20
MHNP 1984-400	Moramanga	16	-	67	112	19		19
MHNP 1984-401	Moramanga	13	+	70	(89)	18		17
MHNP 1933-165	Moramanga	13	-	56	81	21		17
MHNP 1933-164	Moramanga	15	-	51	93	19		19
MHNP 1930-310	Ivohibe	17	-	72	(-)	21		20
MHNP 1994-1741	Ivohibe		-	40	63			20
MHNP 1994-1740	Ivohibe		-	39	(-)			20
MHNP 1930-311	Ikongo	18	-	37	(-)			21
MHNP 1907-84			-	28	42			
MHNP 1994-1739	Ivohibe		-	38	(-)			17
MHNP 1994-1738	Ivohibe		-					17
MHNP 1984-403	Andasibe		-	32	41			
MHNP 1983-886	Mandraka		-	32	(-)			
<i>Zonosaurus brygooi</i>								
ZFMK 46789*	Nosy Be	19/19	-	76		22	44	18
ZFMK 46790#	Nosy Be	17/17	-	63		21	43	19
ZFMK 46792#	Nosy Be	16/16	-	51	94	23	45	17
ZFMK 46793#	Nosy Be	19/17	-	55				18
ZFMK 46794#	Nosy Be	17/16	-	45	84	21	46	18
ZFMK 46795#	Nosy Be	16/17	-	49	75	20	48	18
ZFMK 48165#	Nosy Boraha	16/16	-	74		22	45	18
IRSNB 2.534#	Nosy Be	17/17	-	74		22	45	18
ZMB 19018#	Sakana	16/17	-	69	92	21	45	17
SMF 41053#	Nosy Be	17/17	-	68		21	47	19
MHNP 1984-402	Manompana	17	-	58	(-)	21		19
MHNP 1937-15	Betampona	16	-	55	81	21		17
MHNP 1937-14	Betampona	15	-	53	97	21		16
MHNP 1983-598	Manompana	15	-	71	125	21		16
MHNP 1983-601	Nosy Mangabe		-	36	(-)			
MHNP 1983-599	Nosy Mangabe		-	36	(-)			
MHNP 1983-602	Tampolo		-	33	(-)			
MHNP 1983-600	Nosy Mangabe		-	34	(-)			
MHNP 1950-311	Fenerive-Tampolo	16	-	52	(-)	22		19
MHNP 1950-312	Manjabe		-					17
MHNP 1984-404	Autsingy		-	33	(-)			18
<i>Zonosaurus rufipes</i>								
19.01.92	Nosy Be	12/12	+	35	62	22		
19.01.92	Nosy Be	13/13	+	35	63	22		
08.02.92	Nosy Be	11/12	-	37	64	24	46	20
08.02.92	Nosy Be	9/9	-	35	64	24	49	20
08.02.92	Nosy Be	10/10	+	35		25	47	21
08.02.92	Nosy Be	8/8	+	36	69	24	46	21
08.02.92	Nosy Be	11/12	+	34		26	50	19
08.02.92	Nosy Be	11/11	-	40		23	45	21
08.02.92	Nosy Be	11/12	+	41	75	24	49	19
11.02.92	Nosy Be	12/12	+	70	127	24	48	22
ZFMK 53978	Nosy Be	10/11	-	77	135	22	47	20
ZFMK 53979	Nosy Be	8/9	+	69	102	24	48	20
ZFMK 53980	Nosy Be	8/8	+	70	128		47	19
ZFMK 53981	Nosy Be	9/10	+	30	49	22	49	20
ZFMK 53983	Nosy Be	10/11	+	31	59		49	19
SMF 40743*	Nosy Be	13/13	-	85		25		22
<i>Zonosaurus subunicolor</i>								
28.01.92	Nosy Be	11/11	+	77	139	25	48	22
31.01.92	Nosy Be	11/13	+	75	143	25	49	19/20
21.02.92	Nosy Be	9/11	+	68	120	22		20
ZFMK 53984	Nosy Be	12/11	+	86	143	24	48	21
ZFMK 53985	Nosy Be	11/12	+	73		22	45	20
ZFMK 53986	Nosy Be	9/10	+	63	123		48	19
ZFMK 53987	Nosy Be	11/11	+	75	135		46	20
ZFMK 53988	Nosy Be	8/9	+	31		22	48	20
SMF* 41051	Nosy Be	10/10	+	45	97		46	22
SMF# 41052	Nosy Be	11/11	+	38		25	45	20

Table 1. Meristic and morphometric values of the studied specimens belonging to the *Z. aeneus* group. - Abbreviations used: Fem.Por. = number of femoral pores (separately for both femurs); IP = interparietal (+ present [but always very small], - absent); SVL = snout-vent length; TaL (tail length); Mid.Bod. = number of scales around midbody; CH-CL number of scales between chin and cloaca (including mental scale); 4. Toe = number of lamellae under fourth toe; \* = Lectotype/Holotype; # = Paralectotype/Paratype. - Due to different reasons, mainly bad state of conservation or difficulties caused by small size, some measurements and counts were not taken from all specimens. Values of 4. Toe and Fem.Por. were sometimes taken on both legs. When only one value is given, this refers only to one leg. An autotomized tail is recorded as (-) in the tail length column, length of clearly regenerated tails is given in brackets. Data of IRSNB 2.534, ZMB 19018, SMF 41051-41053 from LANG & BÖHME (1990).

Böhme 1990). We will refer to this group as the *Zonosaurus aeneus* group, named after the oldest of the included taxa.

Fieldwork between 1991 and 1995 revealed problems in the differential diagnosis of these taxa, and showed the need of critical revision of the preserved material belonging to this group. Furthermore, intensive surveys on the small Malagasy island Nosy Be demonstrated the existence of an additional species of this group which corresponds well with the type material of *Gerrhosaurus rufipes* var. *subunicolor* BOETTGER 1881, presently synonym of *Zonosaurus rufipes*. GLAW & VENCES (1992, 1994) already considered *Zonosaurus subunicolor* a valid species, but referred to unpublished data. The formal resurrection of this taxon, and the detailed discussion of this taxonomic conclusion, are the aim of the present paper.

#### Material and methods

Field observations on specimens referred to the *Zonosaurus aeneus*-group were made at the following localities: Nosy Boraha (*Z. brygooi*), Nosy Mangabe (*Z. brygooi*), Andasibe (*Z. aeneus*), Antorotorofotsy, north of Andasibe (*Z. aeneus*), Marojejy (*Z. rufipes*), Benavony (*Z. rufipes*), Nosy Komba (*Z. subunicolor*), Nosy Be (*Z. subunicolor*,

*Z. rufipes*). For a more exact location of these sites see GLAW & VENCES (1994).

Morphological data were taken from both preserved museum material and from living, successively released, specimens in the field. All specimens studied are listed in Table 1. Used museum acronyms are: AMNH (American Museum of Natural History, New York), BM (Natural History Museum, London), CAS (California Academy of Sciences, San Francisco), IRSNB (Institute Royale des Sciences naturelles, Bruxelles), MHNP (Museum National d'Histoire Naturelle, Paris), NMW (Naturhistorisches Museum, Wien), SMF (Senckenberg-Museum, Frankfurt am Main), ZFMK (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn), ZMB (Zoologisches Museum der Humboldt-Universität, Berlin). For specimens measured in the field we give the date at which they were captured. For abbreviations of measurements see Table 1.

Statistical analyses were carried out with the software package SPSS for Windows. Species were pairwise compared with Student's t-tests and with non-parametrical Mann-Whitney-U-tests. Significance values found with these two methods did not differ substantially from each other. All statistical information in the following sections refers to comparisons of the data listed in Table 1 with U-tests.

## Results

### *Zonosaurus aeneus* (GRANDIDIER 1872)

Type: MHNP 7634. The holotype is a juvenile specimen in bad state of preservation. Attribution of adult specimens to the taxon *aeneus* is therefore rather problematic and will be discussed below. Several characters of the type are provided by BRYGOO (1985a). There are no paratypes. No type locality is mentioned in the original description. MOCQUARD (1895) states that it is Malaimbandy ("Pays des Sakalaves") in western Madagascar, without giving his source of information. The locality is therefore somewhat doubtful and, following BRYGOO (1985b), may be due to confusion with the type locality of *Euprepes sakalava*, (currently synonym of *Mabuya elegans*).

Other material: Examination of the preserved material labelled as *Z. aeneus* in the MHNP clearly revealed the existence of two different forms included in the taxon. One group of specimens collected at mid-altitude localities of eastern Madagascar has distinct continuous narrow dorsolateral stripes which continue on the anterior half of the back until they fade. The second

group of individuals, from different lowland localities on the east coast, have no continuous dorsolateral stripes. Either these lack completely, or exist only in form of rows of isolated light spots. Only one meristic character was found to be in all cases diagnostic between these two forms: In specimens with dorsolateral stripes the first supralabial posterior to the subocular was undivided, whereas this scale was divided in specimens without dorsolateral stripes. We did not observe the undivided state of this character in any other *Zonosaurus* species.

Identity of *Z. aeneus*: The taxon *aeneus* was historically the first described *Zonosaurus* species with 3 supralabials anterior to the subocular. Because of the bad conservation state of the holotype and its juvenile colouration only meristic characters remain to attribute a *Zonosaurus* form to *aeneus*. The first supralabial posterior to the subocular is undivided in the type; we therefore consider specimens with this character, which also share narrow dorsolateral stripes as *Z. aeneus*. This definition

