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Rediscovery of the enigmatic blind snake genus *Xenotyphlops* in northern Madagascar, with description of a new species (Serpentes: Typhlopidae)

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Abstract

After more than a century the rare blind snake genus *Xenotyphlops* Wallach & Ineich (1996) has been rediscovered in Madagascar, with the collection of a specimen from the arid northern part of the country. This represents only the third known *Xenotyphlops* specimen and establishes the first precise locality for the genus. As it differs from *Xenotyphlops grandidieri* (Mocquard) in several external and numerous internal features, it is here described as a new species.

Key words: *Xenotyphlops*, Typhlopidae, *X. grandidieri*, new species, Madagascar, viscera

Introduction

In the beginning of the twentieth century, the French herpetologist François Mocquard (1905) described a most unusual typhlopid, named *Typhlops grandidieri*, based upon two specimens with the vague type locality of "Madagascar." This bizarre scolecophidian has been known solely from the type specimens for more than 100 years (Guibé, 1958; Blanc, 1971; Brygoo, 1983, 1987; McDiarmid et al., 1999). Wallach & Ineich (1996) erected the genus *Xenotyphlops* to reflect the distinctness of this blind snake, which shared some peculiar characteristics typical of the Leptotyphlopidae (e.g., single enlarged anal shield, absence of a tracheal lung, cranially positioned heart with long heart-liver gap, heavily vascularized, unicameral right lung lacking avascular terminal portion, and type G bronchial foramina). However, the majority of characters corroborated its inclusion within the Typhlopidae (e.g., dentigerous maxilla and edentulous dentary, 20 midbody scale rows, costal/vertebral ratio greater than 1.0, a single pelvic element, left liver lobe forming anterior extension, and unipartite liver). On the other hand, some further characters suggested a relationship to the *Rhinotyphlops* (= *Letheobia fide* Broadley & Wallach, 2000; Wallach, 2005) *simoni* and/or *R. caecus* species groups, such as the lack of visible eye, reduction of most head shields, T-0 supralabial imbrication pattern, corneal cutting edge on rostral, inferiorly located nostrils, elongated body with uniform diameter throughout, and absence of scale row reduction, pigmentation and apical spine. Additionally, a unique scolecophidian feature was described: soft, flexible cephalic papillae on the rostral shield (Wallach & Ineich, 1996: Fig. 1).

Guibé (1958) and Wallach & Ineich (1996) illustrated the species but it remained the only Malagasy typhlopid for which no specific locality was available (Werner, 1921; Hahn, 1980; Glaw & Vences, 1994; McDiarmid et al., 1999). The obscure phylogenetic position and the geographic vagueness of its provenance made this typhlopid highly enigmatic. Due to this, the discovery of an individual clearly belonging to the

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genus *Xenotyphlops*, and resembling *X. grandidieri*, now permits a more accurate redefinition of the genus and elucidates the first known locality for the genus in Madagascar. Based upon the differences between the significant morphological characters presented below, in conjunction with comparative data, we consider this specimen to represent a new species that we describe herein.

Materials and methods

Visceral characters are described in Wallach (1985, 1991, 1993b–c, 1998a–b) and Wallach & Ineich (1996), and the references cited therein. The "prefrontal" shield of Leptotyphlopidae and Typhlopidae has been shown to be homologous to the typical frontal (Wallach, 2003). Organ lengths and points, gaps and intervals, and organ midpoint-midpoint segments presented as percent snout-vent length (% SVL), midpoint (MP) usually following organ length parenthetically. Ratio of one organ to another presented as decimal fraction. Organ length denoted by name of organ itself (i.e., heart = heart length) and % SVL indicated by % sign (liver MP 51.2% = liver midpoint at 51.2% SVL). In Table 2, MP refers to organ or interval midpoints. Museum acronyms follow Leviton et al. (1985).

Taxonomy

***Xenotyphlops mocquardi* n. sp.**
(Figs. 1–4)

Holotype. MRSN R3208 (field no. FAZC 13182), an adult female collected by V. Mercurio, on 14 January 2005.

Type locality. Ambodivahibe (approximately 12 km SE Antsiranana), Antsiranana Fivondronana, Antsiranana Faritany, 22°23'25"S, 49°26'20"E, elevation ca. 40 m.

Diagnosis. *Xenotyphlops mocquardi* can be immediately diagnosed from all other Typhlopidae by its lateral snout profile (with greatly enlarged circular rostral that is nearly vertically oriented) or anal shield (which is single and broad as in many Alethinophidia). Internally it is unique among the Typhlopidae in the absence of a tracheal lung and expanded tracheal membrane, presence of type G tracheal foramina, and a long heart-liver gap. From *Letheobia* (=*Rhinotyphlops*), which contains its apparently closest relatives, *X. mocquardi* can be separated by a long tail (3.7% vs. < 0.7–2.2% total length with a length/width ratio of 2.7 vs. 0.7–1.7) that does not taper distally, high number of subcaudals (22 vs. 6–17), and short snout-heart interval (26.4% vs. 29.5%–40.7% SVL). Additionally, *Xenotyphlops mocquardi* can be distinguished from its congener *X. grandidieri* by midbody scale rows (22 vs. 20), posterior scale row reduction present (vs. absent), third supralabial (larger than fourth vs. fourth larger than third), orientation of anteroventral rostral point (ventrally vs. anteriorly), vestigial left lung (present vs. absent), and anterior liver extension (right lobe vs. left lobe).

Etymology. This species in named in honor of François Mocquard (1834–1917), the herpetologist who described *Xenotyphlops grandidieri*. During his life Mocquard contributed in a substantial way to the knowledge of Malagasy herpetofauna (Glaw & Vences, 1994), culminating in his grand systematic synopsis (Mocquard, 1909).

Description. An adult female with nearly uniform diameter throughout, snout-vent length 248.5 mm, tail length 9.5 mm, tail/total length 3.7%, midbody diameter 4.1 mm (nuchal diameter 3.5 mm, cloacal diameter 3.6 mm), total length/midbody diameter ratio 62.9, midtail diameter 3.5 mm, tail length/tail width ratio 2.7; scale rows 22-22-20, middorsals 478, subcaudals 22, dorsocaudals 21, anal shield transversely enlarged and single, three scales wide with anterior margin bordered by five scales; tail with uniform diameter throughout,

apex rounded, lacking terminal spine; head narrower than neck, snout truncated in dorsal view; rostral narrowly visible in dorsal view due to its angle; rostral very large, and sub-circular, covered with numerous minute, dome-like convexities and with an acute, ventrally directed point projecting from narrow corneal cutting edge; rostral width/head width ratio 0.90; frontal fused with supraoculars to form narrow broad shield bordering caudal edge of rostral and contacting supranasals laterally; discrete parietals and occipitals lacking; lateral profile of snout with plane of rostral nearly vertical, rostral with an acute apex directed ventrally; second largest shield (after rostral) is supranasal, which widens ventrally and contacts supralabials I–III, minute crescent-shaped infranasal separated completely from supranasal by inferior nostril (that contacts rostral) and inferior nasal suture, which contacts supralabial II; preocular absent, presumably fused with supranasal; ocular small, eye invisible, subocular larger than ocular, in contact with supralabial III; 3 postoculars; SIP T-0, supralabial I minute with pointed anterior end, supralabial II twice the size of supralabial I, supralabial III largest, 1.5 times as long as tall, twice the size of supralabial IV and six times as large as supralabial II, supralabial IV taller than broad with a medial indentation (indicative of fusion of two scales); mental shield enlarged and projecting into notch in upper jaw.

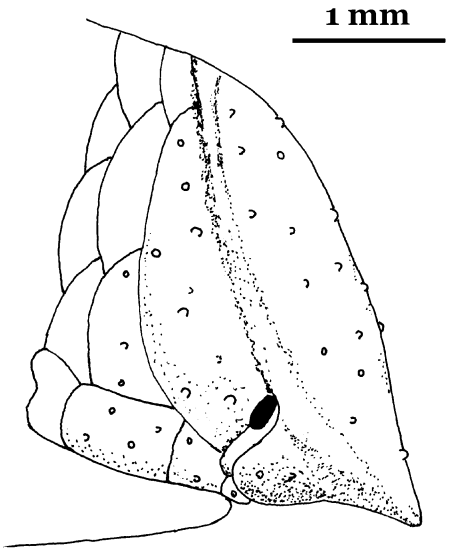

FIGURE 1. Lateral view of head of the holotype (MRSN R3208) of *Xenotyphlops mocquardi*, showing unique profile with vertically-oriented rostral.

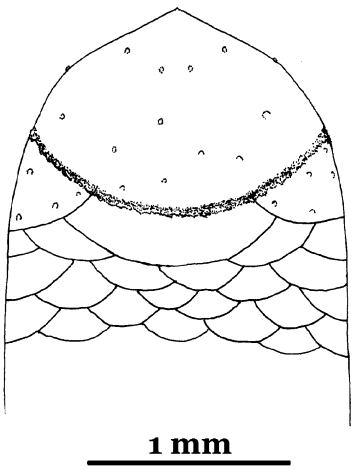

FIGURE 2. Dorsal view of head of the holotype (MRSN R3208) of *Xenotyphlops mocquardi*, with extremely large rostral, nearly as broad as the head.

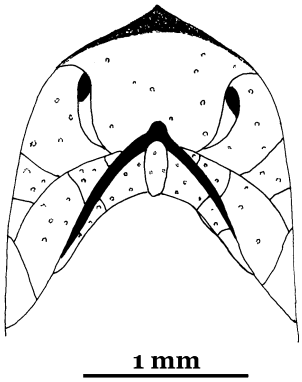

FIGURE 3. Ventrolateral view of head of the holotype (MRSN R3208) of *Xenotyphlops mocquardi* showing enlarged supralabial III, minute infranasal, and projecting mental with corresponding rostral notch.

FIGURE 4. The female (MRSN R3208) photographed in life at Ambodivahibe, northern Madagascar (by V. Mercurio).

Colouration. In life the specimen exhibited a pink colouration, with some translucent parts that made visible the darker internal organs. In general, anyhow, pigmentation is lacking throughout the entire body. After two years of collection the holotype is now whitish.

Viscera. Sternohyoideus muscle posterior tip 8.2%, sternohyoideus-heart gap 0.65; heart 3.0% (MP =

24.8%), elongate with right atrium 0.67 heart length, ventricle 0.53 heart length, and left atrium 0.40 heart length, ventricle length/width 2.0, snout-heart interval 26.4%; heart-liver gap 7.6%, heart-liver interval 45.1%, heart-gall bladder gap 41.6%; liver narrow, straight, and unipartite, each lobe with a single notch (less than width of lobe), colouration light brown with a pattern of black reticulations forming cris-crossing network of roughly parallel lines, right liver lobe 30.2% (MP 53.3%), unsegmented but with notch at 45.5%, left liver lobe 19.5% (MP 43.8%), unsegmented but with notch at 47.3%, total liver 49.7% (MP 51.2%), total liver segments 2, left liver/right liver 0.65, anterior liver extension (0.12 liver length) on right lobe as in Leptotyphlopidae, posterior liver tail (0.43 liver length) also on right lobe; liver tip overlapping gall bladder (liver-gall bladder gap - 0.4%), liver-gall bladder interval 31.4%, liver-kidney gap 21.3%, liver-kidney interval 57.5%; gall bladder 1.6 % (MP 68.8%), anterior to and slightly overlapping pancreas (1.4%), spleen not detectable; gall bladder-kidney gap 20.1%, gall bladder-kidney interval 27.8%, gall bladder-gonad gap 10.1%; right ovary 3.6 % (MP 81.5%), left ovary 2.2% (MP 86.4%), total ovary 5.8% (MP 84.0%); right adrenal MP 82.9%, left adrenal MP 87.7%, total adrenal MP 85.3%; gonad-kidney gap 2.2%, kidneys smooth, right kidney 4.4% (MP 92.0%), left kidney 4.4% (MP 93.6%), total kidney 8.8% (MP 92.8%), kidney overlap 0.47 kidney length, kidney-vent gap 4.2%, kidney-vent interval 10.3%; rectal caecum small (1.4%), bulbous and twice the diameter of adjacent intestine, caecum-vent interval 10.9%, caecum/left kidney 0.32.

Respiratory system lacking tracheal lung, expanded tracheal membrane, left orifice and left bronchus but with a small (0.6%) teardrop shaped expansion of vascular tissue on ventrolateral aspect of right lung just posterior to heart apex (MP 27.1%), precisely where a vestigial left lung would be located. This structure has no free edges, being fused with the parenchyma of the right lung, but has a hollow inner air chamber with a connection to the tracheal airway via the small type G foramen between the tracheal tips. It is reminiscent of a blind sac since no bronchus or typical large orifice are present, but since it is vascularized it must be considered a left lung. Trachea (25.6%, MP 13.6%) with pink cartilages and clear interspaces of equal width, lacking free tips, numbering approximately 273 (or 107.7/10% SVL); tracheal membrane thin and avascular, extending along right lateral aspect of trachea, tracheal membrane/tracheal ring ratio at midpoint 0.33; terminal tracheal entry into right lung, anterior tip of parenchyma 24.9%, cardiac lung 1.4%, right lung highly vascular, 23.1 % (MP 37.9%), with two layers of small, thin-walled faveoli along cranial third of organ, a single layer of larger ediculae along caudal 2/3 of lung, lacking avascular portion, tapering to posterior tip at 49.5%; intrapulmonary bronchus short 7.0% with tiny type G foramina between the cartilage tips, posterior tip of bronchus at 33.4%, bronchus/right lung 0.30; trachea-bronchus 32.6% (MP 17.1%); trachea-bronchus/total lung 0.66.

Organ midpoint-organ midpoint segments include heart MP-right lung MP (13.1%), trachea MP-liver MP (27.6%), heart MP-liver MP (28.5%), liver MP-total kidney MP (39.5%), trachea-bronchus MP-gall bladder MP (39.6%), right lung MP-total adrenal MP (47.4%), heart MP-right gonad MP (56.7%), trachea MP-total adrenal MP (59.6%), trachea-bronchus MP-total kidney MP (63.6%), and heart MP-total kidney MP (68.0%).

Reproduction. Right oviduct hypertrophied (2.5 mm wide), enlarged with thickened walls with two elongate bulges posteriorly that retain the shape of what is interpreted as two large eggs (both exactly 5 mm long or 2.0% SVL) that had been laid shortly before capture on January, thus suggesting that oviposition occurs in the summer. The right ovary held 3 vitellogenic ova (1.5 x 0.75 mm [2] and 1.0 x 0.5 mm) and one small follicle; the left ovary had eleven very small follicles.

Habitat. The specimen was found along a nearly dry sun exposed stream surrounded by riverside vegetation with thin sandy soil substratum and some scattered water pools with a deep of about 20–30 cm. Outside the riverbed the area is characterized by a dry bushy savannah. This species appears similar ecologically to the xeric-adapted Leptotyphlopidae (i.e., *Leptotyphlops macrorhynchus)* and Typhlopidae (i.e., *Letheobia episcopa)* that occupy moist fringes of sandy arid regions (Schleich et al., 1996; Franzen & Wallach, 2002; Baha el Din, 2006).

TABLE 1. Morphological comparison of *Xenotyphlops grandidieri* and *X. mocquardi*.

Character	*Xenotyphlops grandidieri*	*Xenotyphlops mocquardi*
Specimen	MNHN 1905.272	MRSN R3208
Snout-vent length	248.0–249.0 mm	248.5 mm
Total length	257.0–257.0 mm	258.0 mm
Anterior scale rows	20	22
Midbody scale rows*	20	22
Posterior scale rows	20	20
Posterior scale row reduction*	no	yes
Inferior nasal suture contacts*	second supralabial	rostral
Largest supralabial*	IV	III
Postoculars	3–4	3
Rostral width/head width	0.65	0.90
Anterior rostral point directed*	anteriorly	ventrally
Left lung*	absent	present
Anterior liver extension*	left lobe	right lobe
Left liver/right liver ratio	0.98	0.65
Posterior liver tail (% liver length)	0.19	0.49
Kidney-vent interval/right liver length	0.43	0.34
Rectal caecum/heart	0.78	0.47
Rectal caecum/left kidney	0.58	0.32

Justification for the new species. The two species differ in seven external characters enumerated in Table 1 (see characters denoted by *) and for the numerous differences in size and position of the viscera as shown in Table 2. Neither species can be confused with any other typhlopid based upon the unique lateral head profile and anal shield. We are aware that the sample size is minimal but both specimens of *Xenotyphlops* (paralectotype of *X. grandidieri* MNHN 1905.271, and holotype of *X. mocquardi,* MRSN R3208) for which visceral data are available are females of identical length so the data are comparable and the observed differences cannot be attributed to either ontogeny or sexual dimorphism.

Revised definition of *Xenotyphlops.* Examination of the freshly preserved *Xenotyphlops mocquardi* necessitates revision of the generic diagnosis of *Xenotyphlops* due to one major error in its description. A supposedly unique character of *Xenotyphlops* was the presence of numerous soft, flexible papillae on the rostral shield, which necessitated hypothesizing a wet microhabitat for the snake (Wallach & Ineich, 1996). It is now obvious that the rostral shields of both *X. grandidieri* specimens had sloughed off, a not uncommon occurrence in century-old, poorly preserved serpents, and what was taken to be external papillae are actually the soft tissue structures lying beneath the typical granular, dome-like convexities found in xeric-adapted typhlopids and leptotyphlopids. Presumably these structures have a sensory function, as they appear to be extensions of the nervous system.

According to this new definition, the genus *Xenotyphlops* is distinguishable externally from all members of the Typhlopidae by its greatly enlarged and nearly circular rostral shield that is nearly vertical in lateral aspect (giving it a ‘bulldozer” appearance) and a single enlarged anal shield. Internally *Xenotyphlops* is unique among typhlopids in lacking a tracheal lung and possessing an unexpanded tracheal membrane, type G tracheal foramina, and a long heart-liver gap. Other characters that are rare within the family include absence of a preocular, presence of a subocular that is larger than the ocular, absence of a visible eye, T-X supralabial imbrication pattern, elongate body of uniform diameter, absence of an apical spine, pigmentless pattern, and unipartite liver.

TABLE 2. Comparison of the visceral characters of female *Xenotyphlops grandidieri* and *X. mocquardi* as % SVL.

Character	*Xenotyphlops grandidieri*	*Xenotyphlops mocquardi*
Specimen	MNHN 1905.271	MRSN R3208
Heart MP	22.3	24.8
Snout-heart interval	23.7	26.4
Heart-liver gap	4.8	7.6
Heart-liver interval	31.9	45.1
Right liver lobe	20.7	30.2
Total (left + right) liver length	41.0	49.7
Right liver MP	42.5	53.3
Left liver MP	38.7	43.8
Total (left + right) liver MP	40.7	51.2
Liver-gall bladder gap	8.6	0.4
Liver-kidney gap	38.2	21.3
Gall bladder-kidney gap	28.1	20.1
Gall bladder-kidney interval	34.7	27.8
Gall bladder-gonad gap	16.1	10.1
Right ovary length	1.4	3.6
Left ovary length	1.2	2.2
Right ovary MP	79.6	81.5
Left ovary MP	83.7	86.4
Total (left + right) ovary MP	81.7	84.0
Gonad-kidney gap	6.6	2.2
Left adrenal MP	85.5	87.7
Rectal caecum length	2.2	1.4
Trachea length	22.9	25.6
Right lung anterior tip	22.5	24.9
Right lung length	20.7	23.1
Right lung MP	34.0	37.9
Right lung posterior tip	44.4	49.5
Bronchus posterior tip	29.7	33.4
Trachea + bronchus length	28.9	32.6
Trachea-bronchus MP	15.3	17.1
Trachea MP-liver MP	30.3	27.6
Trachea MP-total adrenal MP	72.1	59.6
Trachea-bronchus MP-gall bladder MP	46.8	39.6
Trachea-bronchus MP-total kidney MP	78.3	63.6
Heart MP-liver MP	20.2	28.5
Liver MP-total kidney MP	51.1	39.5

MP = midpoint.

Little can be said about the affinities of the two species of *Xenotyphlops* with the other typhlopids of Madagascar, since up to now no detailed phylogenetic analysis has been carried out. In the only phylogenetic analysis to date on the Scolecophidia, which was unfortunately analyzed only to the species group level,

Xenotyphlops was found to be the sister group to the *Ramphotyphlops angusticeps* group of Australia, which itself was sister group to the *R. australis* and *R. bituberculatus* groups with the basal *R. affinis* group being the most primitive (Wallach, 1998b: Fig. 4). This surprising finding suggests a relationship to Australian rather than Malagasy taxa. It is even more remarkable that *Xenotyphlops* shows some resemblance to the Leptotyphlopidae and we can add one additional character of *X. mocquardi* in the arrangement of the liver lobes: the right liver lobe lies craniad of the left, a condition unknown among the Typhlopidae where the left liver lobe extends cranially of the right (as also in *X. grandidieri)*. It is possible that our specimen of *X. mocquardi* is aberrant in possessing a shortened left liver lobe but that can only de determined with the examination of further material. The presence of a vestige of the left lung is also noteworthy and indicates retention of a primitive characteristic that is quite rare among scolecophidians (Wallach, 1993b).

Discussion

The collection of *Xenotyphlops mocquardi* in Madagascar provides evidence that Maurice de Rothschild, the donor of *X. grandidieri*, obtained the two type specimens from some source in Madagascar, and not from mainland Africa, even though he personally made only two African expeditions (Wallach & Ineich, 1996).

Anyhow, we do not have any information from where the types of *Xenotyphlops grandidieri*, although the finding of a new species compels us to revise our view of the presumed habitat of this genus, providing therefore some indications of the presumed geographic localities. In fact, the absence of external soft rostral papillae in *Xenotyphlops*, a generic character previously considered diagnostic (Wallach & Ineich, 1996), resolves the difficult proposition that the genus inhabited a muddy or aquatic habitat. Instead, the presence of granular domes (Figs. 2–3) covering these papillae indicates that the genus inhabits a xeric environment because those leptotyphlopids and typhlopids having such structures come from very dry or desert areas. This consideration has been just confirmed by the habitat observation regarding *X. mocquardi*, which was found in a dry savannah. Therefore, we predict that *X. grandidieri* should inhabit the western coast of Madagascar, which contains an abundance of xeric habitats.

The finding of this new typhlopid species indicates, once more, that most of the Malagasy herpetofauna is highly secretive, and in general difficult to be detected. It is amazing that the genus *Xenotyphlops* remained unconfirmed for more than one century, despite the many field surveys conducted in Madagascar. More surprising was that the newly found individual belonged to a different species. Among the reptiles the existence of species represented by a single or a few specimens is not unusual. This usually occurs particularly in fossorial species, such as scolecophidian genera like *Grypotyphlops*, *Rhinoleptus*, and *Cyclotyphlops* (Peters, 1881; Orejas-Miranda et al., 1970; Bosch & Ineich, 1994) and skinks belonging to the genera *Pseudoacontias* and *Paracontias* (Nussbaum & Raxworthy, 1995; Andreone & Greer, 2002; Sakata & Ikida, 2003).

Thus, it is clear that fossorial reptiles are good candidate by "escaping" scientific surveys. One way to increase the probability to get these animals is to work in a standardized manner by means of pitfall traps. However, the new *Xenotyphlops* was found during opportunistic research, by moving on the ground surface. Since no heavy rainfall occurred before we ignore the reason for this unusual behavior.

We hope that more individuals of *Xenotyphlops mocquardi* will be found in the future, likely conducting more intensive research in the Ambodivahibe coastal area as done in the near renewed Montagne des Français. Taken into consideration the high reptile endemism detected at the latter locality (Glaw et al., 2001, 2005a, 2005b), and the fact that the site hosts some relevant populations of *Mantella viridis* (Andreone et al., 2006), it is suggested that Montagne des Français / Ambodivahibe should be included in the forthcoming protected area network for the safeguard of his rocky forested slopes and of the dry bushy savannah hosting an unique herpetofauna.

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Literature cited

Andreone, F. & Greer, A.E. (2002) Malagasy scincid lizards: descriptions of nine new species, with notes on the morphology, reproduction and taxonomy of some previously described species (Reptilia, Squamata: Scincidae). *Journal of Zoology*, 258, 139–181.

Andreone, F., Mercurio, V. & Mattioli, F. (2006) Between environmental degradation and international pet trade: conservation strategies for the threatened amphibians of Madagascar. *Natura - Società italiana di Scienze naturali e Museo civico di Storia naturale di Milano*, 95(2), 81–96.

Baha el Din, S. (2006) *A guide to the reptiles and amphibians of Egypt.* The American University in Cairo Press, Cairo, xvi + 359 pp.

Blanc, Ch.P. (1971) Les reptiles de Madagascar et des îles voisines. *Annales de l'Université de Madagascar,* (8), 95–178.

Bosch, H.A.J. in den & Ineich, I. (1994) The Typhlopidae of Sulawesi (Indonesia): a review with description of a new genus and a new species (Serpentes: Typhlopidae). *Journal of Herpetology*, 28(2), 206–217.

Broadley, D.G. & Wallach, V. (2000) A new blind snake (Serpentes: Typhlopidae) from montane forests of the Eastern Arc Mountains in Tanzania. *African Journal of Herpetology*, 49(2), 165–168.

Brygoo, E.R. (1983) Les ophidiens de Madagascar. *Memorias do Instituto Butantan*, (1982) 46, 19–58.

Brygoo, E.R. (1987) L'endémisme des reptiles de Madagascar. *Bulletin de la Société Zoologique de France*, 112(1–2), 5–38.

Franzen, M. & Wallach, V. (2002) A new *Rhinotyphlops* from southeastern Turkey (Serpentes: Typhlopidae). *Journal of Herpetology*, 36(2), 176–184.

Glaw, F., Franzen, M. & Vences, M. (2005a) A new species of colubrid snake (*Liopholidophis*) from northern Madagascar. *Salamandra*, 41(1/2), 83–90.

Glaw, F. & Vences M. (1994) *Amphibians and reptiles of Madagascar.* 2nd ed. Vences und Glaw Verlag, Cologne, 480 pp.

Glaw, F., Vences, M. & Nussbaum, R.A. (2005b) A new species of *Heteroliodon* (Reptilia: Squamata: Colubridae) from Montagne des Français, far northern Madagascar. *Herpetologica*, 61, 275–280.

Glaw, F., Vences, M. & Schmidt, K. (2001) A new species of *Paroedura* Günther from northern Madagascar (Reptilia, Squamata, Gekkonidae). *Spixiana*, 24(3), 249–256.

Guibé, J. (1958) Les serpents de Madagascar. *Mémoires de l'Institut Scientifique de Madagascar*, (sér. A, Biologie Animale), 12, 189–260.

Hahn, D.E. (1980) Liste der rezenten Amphibien und Reptilien: Anomalepididae, Leptotyphlopida, Typhlopidae. *Das Tierreich*, 101, xii + 1–93pp.

Leviton, A.E., Gibbs, R.H., Jr., Heal, E., & Dawson, C.E. (1985) Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia,* 1985(3), 802–832.

McDiarmid, R.W., Campbell, J.A., & Touré, T.A. (1999) *Snake species of the world: a taxonomic and geographic reference. Volume 1*. The Herpetologist's League, Washington, 511 pp.

Mocquard, F. (1905) Note préliminaire sur une collection de reptiles et de batraciens offerte au Muséum par M. Maurice de Rothschild. *Bulletin du Muséum d'Histoire Naturelle*, 11(5), 285–289.

Mocquard, F. (1909) Synopsis des familles, genres et espèces des reptiles écailleaux et des batraciens de Madagascar. *Nouvelles Archives du Muséum, Paris* (sér. 5), 1, 1–110.

Nussbaum, R.A. & Raxworthy, C.J. (1995) Review of the scincine genus *Pseudoacontias* Barboza du Bocage (Reptilia:

Squamata: Scincidae) of Madagascar. *Herpetologica*, 51, 91–99.
Orejas-Miranda, B.R., Roux-Estève, R. & Guibé, J. (1970) Un nouveau genre de leptotyphlopidés (Ophidia), *Rhinoleptus koniagui* (Villiers). *Comunicaciones Zoologicas del Museo de Historia Natural de Montevideo*, 10(127), 1–4.
Peters, W.C.H. (1881) Einige herpetologische Mittheilungen. 1. Uebersicht der zu den Familien der Typhlopes und Stenostomi gehörigen Gattungen oder Untergattungen. *Sitzungsberichte der Gesellschaft Naturforschenden Freunde zu Berlin*, 1881, 69–71.
Sakata, S. & Hikida, T. (2003) A new fossorial scincine lizard of the genus *Pseudoacontias* (Reptilia: Squamata: Scincidae) from Nosy Be, Madagascar. *Amphibia-Reptilia*, 24(1), 57–64.
Schleich, H.H., Kästle, W. & Kabisch, K. (1996) *Amphibians and reptiles of North Africa.* Koeltz Scientific Books, Koenigstein, 627 pp.
Wallach, V. (1985) A cladistic analysis of the terrestrial Australian Elapidae. *In*: Grigg, G., Shine, R. & Ehmann, H. (Ed.), *The biology of Australasian frogs and reptiles.* Surrey Beatty and Sons & Royal Zoological Society of New South Wales, Chipping Norton, pp. 223–253.
Wallach, V. (1991) Comparative visceral topography of African colubrid snakes of the subfamilies Aparallactinae and Atractaspidinae. M.S. Thesis, Louisiana State University, Baton Rouge, xix + 490 pp.
Wallach, V. (1993a) The supralabial imbrication pattern of the Typhloidea (Reptilia: Serpentes). *Journal of Herpetology*, 27(2), 214–218.
Wallach, V. (1993b) Presence of a left lung in the Typhlopidae (Reptilia: Serpentes). *Journal of the Herpetological Association of Africa*, (42), 32–33.
Wallach, V. (1993c) A new species of blind snake, *Typhlops marxi*, from the Phillipines (Serpentes: Typhlopidae). *The Raffles Bulletin of Zoology*, 41(2), 263–278.
Wallach, V. (1998a) The lungs of snakes. *In*: Gans, C. & Gaunt, A.S. (Ed.), *Biology of the Reptilia. Volume 19 (Morphology G) Visceral organs.* Society for the Study of Amphibians and Reptiles, Ithaca, pp. 93–295.
Wallach, V. (1998b) *The visceral anatomy of blindsnakes and wormsnakes and its systematic implications (Serpentes: Anomalepididae, Typhlopidae, Leptotyphlopidae).* Ph.D. Dissertation, Northeastern University, Boston, xxvi + 611 pp.
Wallach, V. (2003) Scolecophidia miscellanea. *Hamadryad*, 27(2), 222–240.
Wallach, V. (2005) *Letheobia pauwelsi*, a new species of blindsnake from Gabon (Serpentes: Typhlopidae). *African Journal of Herpetology*, 54(1), 85–91.
Wallach, V. & Ineich, I. (1996) Redescription of the rare Malagasy blind snake, *Typhlops grandidieri* Mocquard, with placement in a new genus (Serpentes: Typhlopidae). *Journal of Herpetology*, 30(3), 367–376.
Werner, F. (1921) Synopsis der Schlangenfamilie der Typhlopiden auf Grund des Boulenger'schen Schlangenkatalogs (1893–1896). *Archiv für Naturgeschichte*, 87A(7), 266–338.