

# Rediscovery of the Poorly Known Angolan Adder, *Bitis heraldica* (Bocage, 1889) (Serpentes: Viperidae): New Records, Live Photographs, and First Case History of Envenomation

The Angolan Adder, *Bitis heraldica* (Bocage, 1889), endemic to the Angolan central plateau, is one of the most poorly known and rarely observed species of African snakes. The species was described by Bocage (1889) based on a single specimen collected by the Portuguese explorers Hermenegildo Capelo (1841–1917) and Roberto Ivens (1850–1898) on the banks of the river “Calae” [= Calai], a tributary of the Cunene River, Huíla Province. Since its original description, the species has only been collected and reported a handful of times (Bocage 1895; Boulenger 1905; Monard 1937; Bogert 1940; Hellmich 1957; Mertens 1958) and no records for this species exist since 1953 (Hellmich 1957). The extant specimens in natural history collections are listed in Appendix I. Its known distribution is limited to the rocky slopes at high elevation in western regions of the Angolan central plateau, namely in the provinces of Kwanza Sul, Huambo, Bié, and northern Huíla, being known from no more than eight different localities (Marques et al. 2018). The species has never been evaluated by the IUCN, and nothing is known regarding its biology, behavior, composition or toxicity of the venom, and no case histories of envenomation have been published (Spawls and Branch 1995). The species can be easily distinguished from other small species of the genus *Bitis* due

to its heavily speckled venter, the presence of a “trident” on its forehead, and absence of supraocular ornamentation (Mertens 1958).

The taxonomic and nomenclatural history of the species reflects the paucity of knowledge about it. Initially described as *Vipera heraldica* by Bocage (1889), the species was considered a synonym of *Bitis peringueyi* (Boulenger, 1888) by Boulenger (1896, 1905, 1915), a decision followed by Monard (1937) and Bogert (1940). Ferreira (1897) questioned the decision of Boulenger (1896) and Hellmich (1957), then followed by Mertens (1958), re-established *B. heraldica* as a full and valid species. Subsequent authors (Manaças 1982; Meirte 1992; Spawls and Branch 1995; McDiarmid et al. 1999; Dobiey and Vogel 2007; Phelps 2010; Kucharzewski 2011; Wallach et al. 2014; Branch 2018; Marques et al. 2018) accepted the validity of *B. heraldica* as a full species. The phylogenetic placement of *B. heraldica* within the four subgenera of the genus *Bitis* proposed by Lenk et al. (1999) remains highly problematic. The few recent taxonomic and phylogenetic revisions dealing with African viperids and the genus *Bitis* have lacked molecular data on the species. Following the opinion of Groombridge (1980), Lenk et

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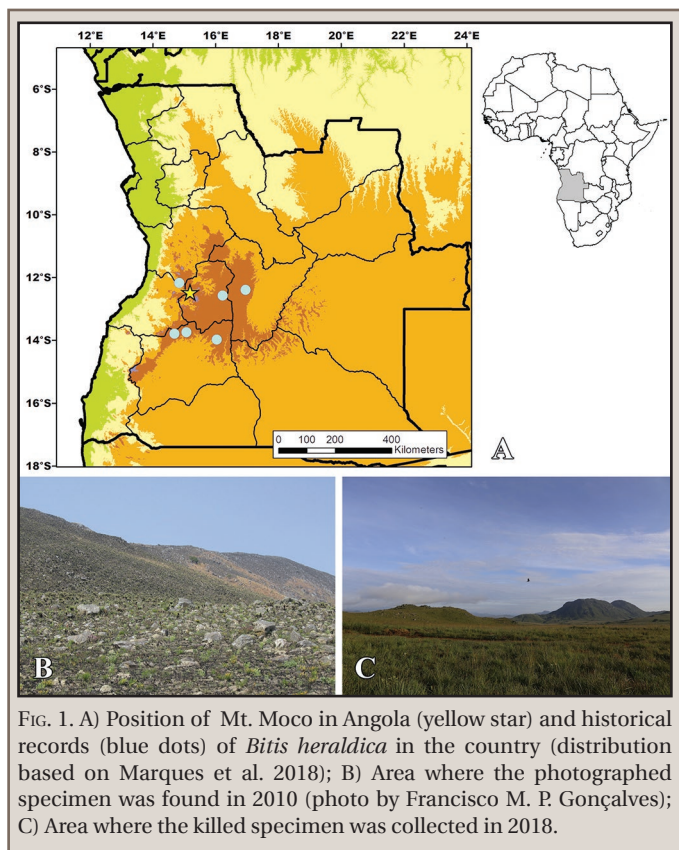


FIG. 1. A) Position of Mt. Moco in Angola (yellow star) and historical records (blue dots) of *Bitis heraldica* in the country (distribution based on Marques et al. 2018); B) Area where the photographed specimen was found in 2010 (photo by Francisco M. P. Gonçalves); C) Area where the killed specimen was collected in 2018.



FIG. 2. Live (uncollected) specimen of *Bitis heraldica* from Mount Moco.

al. (1999) and Wittenberg et al. (2014) considered *B. heraldica* as a member of the subgenus *Calechidna* Tschudi, 1846.

During two independent surveys to Mount Moco (herein Mt. Moco, Huambo Province) (Fig. 1A), we obtained the first life photographs of the species and collected the first new specimen in the last 65 years. Mt. Moco is the highest peak of Angola, with an elevation of 2620 m above sea level and is part of

the Angolan escarpment (Fig. 1). The region is characterized by remnant and isolated patches of Afrotropical forests, dominated by the tree species *Podocarpus milanjanus*, *Pittosporum viridiflorum*, *Olea capensis*, and *Ilex mitis*, located mostly in humid valleys at altitudes of 2000–2500 m (Grandvaux-Barbosa 1970), with Mt. Moco preserving the most pristine example of this type of vegetation in the country (Huntley and Matos 1994).

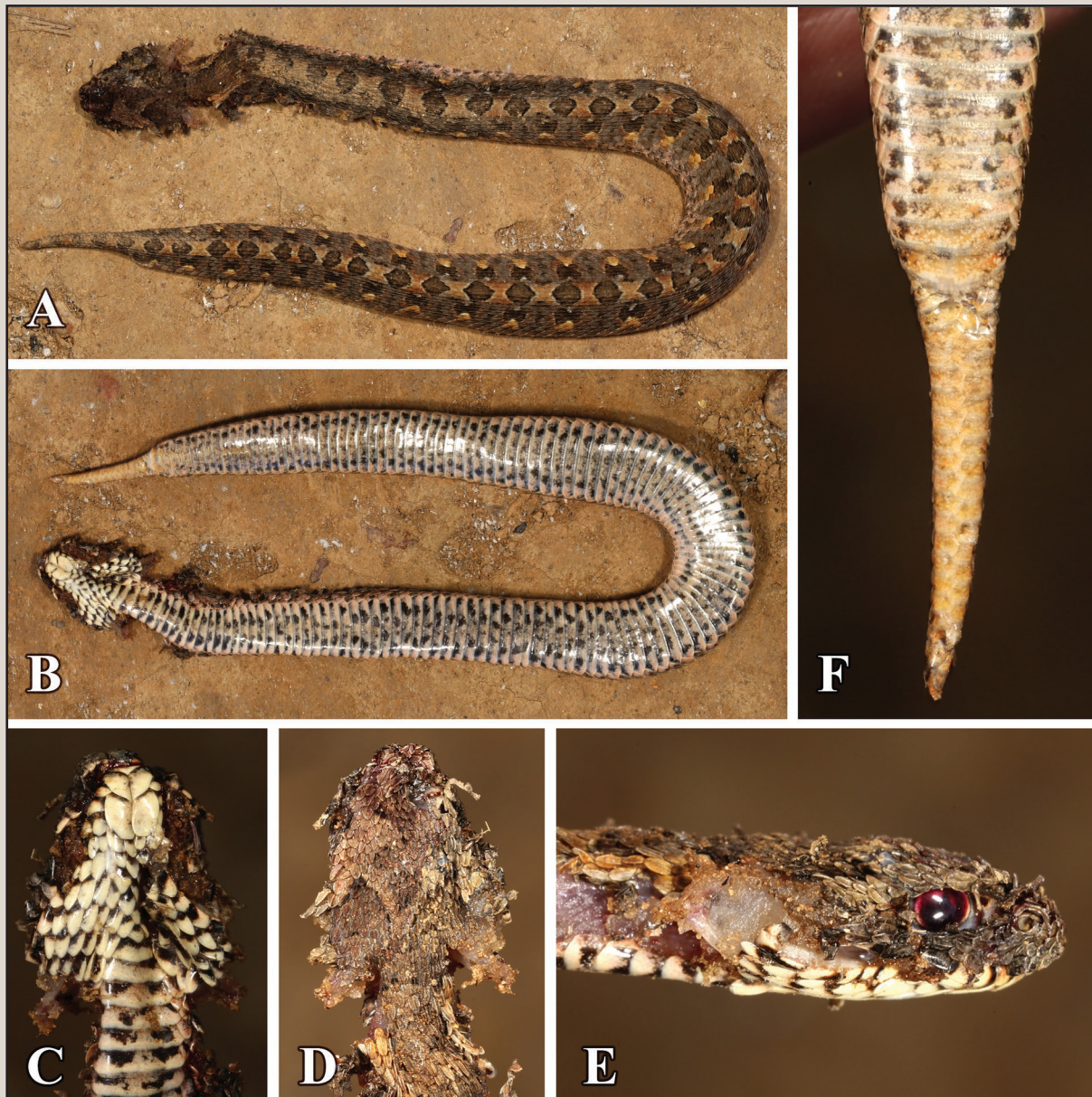


FIG. 3. Dead specimen (CAS 264205) of *Bitis heraldica*. A) Dorsal view; B) Ventral view; C) Ventral view of the head; D) Dorsal view of the head; E) Lateral (right) view of the head; F) Cloacal region and subcaudals.

Here we report the rediscovery and new distributional records for the species, present the first photographs of living specimens, a description of the newly collected specimen, and provide the first case history of envenomation.

On 17 July 2010 during a biodiversity survey to Mt. Moco, the two first authors (FMPG and DB) found and photographed a live specimen of *B. heraldica* (Fig. 2). The specimen was found in an open area at the top of the mountain (-12.00722°, 15.01241°, WGS 84; 2302 m elev.; Fig. 1B) at 1704 h. The specimen was not collected. On 3 March 2018, as a part of a herpetological survey of Mt. Moco, the last three authors (HV, MPM, and LMPC) collected a specimen killed (head and neck crushed) by villagers on the southwestern slope of the Mt. Moco chain, near Kajonde village (-12.42616°, 15.15256°, WGS 84; 1926 m elev.; Fig. 1C). According to the locals who killed it, the specimen was moving on a dirt road, at about 0900 h. Most of the locals present when we collected the snake identified it as “M’ Buta” or

“Ombuta,” a common term used in Kimbundo and Umbundo languages for referring to vipers in Angola. The specimen is currently deposited in the collection of the California Academy of Sciences (CAS 264205; field number AMB 10957; Fig. 3). The collected specimen measures 185 mm snout–vent length, 13.5 mm tail length, and 14.5 mm head length. It has 130 ventrals and 18 rows of paired subcaudals; anal scale entire; midbody scale rows 26, neck scale rows 28, and precloacal scale rows 20; ten supralabials still present, but some areas of the supralabial area destroyed; sublabials 11, with second, third, and fourth in contact with the anterior chin shields; top of the head covered with small, overlapping, keeled scales, with approximately 13 scales between the eyes, 12 scales around the eyes, 3 rows of scales between the eyes and supralabials. The dorsal coloration comprises different tones of brown, with 41 (36 on the body, 5 on the tail) roundish to rhombic blackish spots along an orange middorsal line, bordered on each flank by similar spots, which



FIG. 4. A) Habitat alteration through slash and burn agriculture near Kajonde village, Mt. Moco. B) Active slash and burn practices near Kajonde village, Mt. Moco.

are limited below by a triangular-shaped yellowish marking, within a darker brown matrix (except on the tail). Venter white but heavily speckled with black markings; ventral side of the tail and posterior parts of the venter tinted with orange. These measures and characters agree entirely with the descriptions presented by Bocage (1889, 1895), Hellmich (1957), Mertens (1958), and Spawls and Branch (1995).

These two new records for the species on Mt. Moco expand the known range of the species, whose closest previous records were from “Namba, Mombolo” in Kwanza Sul Province (Bogert 1940), approximately 110 km NE of Mt. Moco, “Bela-Vista” in Huambo Province (Hellmich 1957), 115 km E of Mt. Moco, and “Caconda” in Huíla Province (Bocage 1895), 145 km S of Mt. Moco (see also Marques et al. 2018, for all historical records).

Despite its importance for conservation, Mt. Moco is still poorly documented in terms of its biodiversity. Most recent biodiversity surveys were mostly targeted for birds (Ryan et al. 2004; Mills 2007; Mills et al. 2011), although some species of reptiles and amphibians have already been cited from surrounding areas (Laurent 1964), with one endemic species of lacertid, *Ichnotropis microlepidota*, having been described from there (Marx 1956). Other expeditions and field surveys have recently taken place at Mt. Moco, including the 2018 herpetological survey that yielded the specimen of *B. heraldica* reported here (Ceríaco et al., *in prep.*); these will create a baseline of biodiversity data to support the creation of a Nature Reserve on Mt. Moco.

Viperids face serious conservation challenges around the world. The biggest threats to the survival of many viper species

are loss, degradation, and fragmentation of habitat, illegal and unsustainable collection for the pet trade, human consumption as food, direct persecution due to fear and superstition, and the impact of introduced species (Maritz et al. 2016). These challenges are aggravated by the fact that for many species there are major gaps in the knowledge needed to appropriately conserve vipers, namely basic natural history, ecology, and distributional data (Maritz et al. 2016). This is especially true for *B. heraldica*, as virtually no data exist regarding its natural history and ecology, and distributional data are also quite limited. Although there is no evidence that *B. heraldica* is impacted by human consumption or introduced species, it is clear that loss and degradation of habitat, as well as direct persecution affect the species. The habitat in which the species is found is of high conservation concern, being threatened through burns, collection of fuelwood, and timber harvest (Huntley and Matos 1994; Cáceres 2011). During the 2018 field trip we observed slash and burn agricultural practices and timber logging, very close to the places where the species was found (Fig. 4). The fact that the only collected specimen was killed by a local villager is clear evidence of direct persecution. Although there are no records of any *B. heraldica* having appeared in the pet trade, the species appears to be one of the top priorities for the industry, with much interest in the pet trade community and in online forums (LMPC, pers. obs.). After decades of difficult access to the country, Angola has recently promoted several international agreements to facilitate or waive the need of visas to access the country. Without close control, it is possible that the species can be transported out of the country for the pet trade without the required collecting and exporting permits. Currently the species does not have any legal protection and it is not included in the recently published red list of Angolan species (Ministério do Ambiente 2018).

No data exist on venom composition and envenomation symptomatology for a *B. heraldica* snakebite, as no case history has ever been reported (Spawls and Branch 1995). Surprisingly, Oliveira (2017) listed *B. heraldica* as a species that frequently bites humans and is associated with severe and potentially fatal results. Oliveira (2017) presents a photograph of a *B. arietans* (Puff Adder) from Talamajamba, Benguela Province, wrongly labelled as *B. heraldica*, which suggests that the presumed cases of bites are actually referable to Puff Adders. During our herpetological survey of Mt. Moco, we interviewed local people regarding the snakes that occur in the area, and specifically asked if they had any information or stories regarding snakebite incidents in the area. A local informant, a 45-year-old male who positively identified the species through our dead specimen and photographs, reported that he was bitten by a *B. heraldica* some years ago. The victim was bitten on the lower ankle of the right foot while walking on a dirt road early in the morning near the village of Kajonde. The immediate symptoms included localized pain, which extended across the leg, intense swelling of the afflicted area, and fever. All symptoms resolved without complications after a month but intense pain was felt, and the other symptoms strongly manifested in the first week following the bite. During the first three to four days the pain and swelling impeded the victim's ability to walk. No necrosis was reported, and no marking or scars were left in the bite area. Treatment involved only analgesics (Paracetamol) during the first days. These symptoms are similar to those produced by the venom of other small species of *Bitis*, such as *B. peringueyi*, *B. caudalis*, or *B. worthingtoni* (Spawls and Branch 1995), which suggest a mostly cytotoxic nature.

After decades of violent civil war that engulfed the country from 1975 to 2002, biodiversity surveys are restarting in Angola. In recent years, the herpetofauna of Angola has been the focus of several studies that have contributed to the discovery of cryptic diversity, the description of new species new to science, and the collection of distributional data for conservation areas (Conradie et al. 2012a,b, 2013, 2016; Ceriaco et al. 2014, 2016a,b,c, 2018a,b,c; Branch and Conradie 2015; Stanley et al. 2016; Branch et al. 2017, 2018; Baptista et al. 2018; Marques et al. 2019). The country's geographic position makes it a hotspot of herpetological diversity, being an important area for the study of the West/Central vs. Southern African species turnover (Marques et al. 2018). The rediscovery of *B. heraldica*, one of the most poorly known species of African snakes and certainly one of the world's most mysterious viperids, is a perfect example of how much work is still needed in Angola. The collection of this fresh specimen will allow us to finally determine the taxonomic placement of *B. heraldica* within the four *Bitis* subgenera (Ceriaco et al., *in prep.*) and contributes to our understanding of southwestern Africa biogeographic patterns.

**Acknowledgments.**—We thank Sharon Grant and Alan Resetar (Field Museum of Natural History), David Kizirian and Lauren Vonnahme (American Museum of Natural History), Raffael Ernst (Senckenberg Naturhistorische Sammlungen), Kai Shütte and Jakob Hallermann (Zoologisches Museum Hamburg), Frank Glaw (Zoologische Staatssammlung München), Arnaud Maeder (Musée d'Histoire Naturelle), and Vincent Smith, Patrick Campbell, and Jeff Streicher (Natural History Museum) for access to their collections. MPM and LMPC thank Victor "Paka" from the Instituto Nacional da Biodiversidade e Áreas de Conservação (INBAC) for their support during the fieldwork in 2018. We also want to thank Gunther Köhler and Philipp Wagner for their reviews of the original manuscript and for their respective comments and suggestions. The herpetological survey to Mt. Moco was part of the "Herpetology of Angola" project, a partnership between INBAC/Ministry of Environment of Angola, Villanova University, Florida Museum of Natural History and University of Michigan-Dearborn and funded by the US National Science Foundation to David C. Blackburn (DEB 1202609, 1556559), Aaron M. Bauer (DEB 1019443, 1556255), and Matthew P. Heinicke (DEB 1556585), and a grant to David C. Blackburn and Aaron M. Bauer from the JRS Biodiversity Foundation. Collecting and export permits were issued by INBAC to Luis M. P. Ceriaco (permit number 005/INBAC/MINAMB/2018). MPM is currently supported by FCT contract SFRH/BD/129924/2017.

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## APPENDIX I

LIST OF EXTANT SPECIMENS OF *BITIS HERALDICA* IN NATURAL HISTORY COLLECTIONS

- FIELD MUSEUM OF NATURAL HISTORY, CHICAGO, USA: FMNH 166959 (2 specimens), “Bela Vista” [= Sanguengue, Huambo Province], collected by Adolf von Maydell, 18 April 1953.
- AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK, USA: AMNH R-51891, “Mombolo” [= Mombolo, Kwanza-Sul Province], collected by Arthur S. Vernay, Herbert Lang & Rudyerd Boulton during the Vernay Angola Expedition, between September and October 1925.
- SENCKENBERG NATURHISTORISCHE SAMMLUNGEN, DRESDEN, GERMANY: MTD 30144, “Bela Vista” [= Sanguengue, Huambo Province], collected by Adolf von Maydell, 7 March 1953.
- SENCKENBERG FORSCHUNGS INSTITUT UND NATURMUSEUM, FRANKFURT AM MAIN, GERMANY: SMF 54716, “nördlich von Kunene” [= north of Kunene River, probably in Huíla or Huambo provinces] collected by E. Kramer, 6 June 1955.
- ZOOLOGISCHES MUSEUM HAMBURG, HAMBURG, GERMANY: ZMH R00020, “Bela-Vista, Hochland von Benguella” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 18 April 1953; ZMH R00021, “Bela-Vista, Hochland von Benguella” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 18 April 1953; ZMH R00022, “Bela-Vista, Hochland von Benguella” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 12 December 1952; ZMH R00023, “Bela-Vista, Hochland von Benguella” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 8 March 1953; ZMH R00024, “Bela-Vista, Hochland von Benguella” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 20 April 1953; ZMH R00025, “Bela-Vista, Hochland von Benguella” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 8 March 1953.
- ZOOLOGISCHE STAATSSAMMLUNG MÜNCHEN, MUNICH, GERMANY: ZSM 98/1954, “Bela Vista (Sanguenge)” [= Sanguengue, Huambo Province], collected by Adolf von Maydel, 5 May 1953.
- MUSÉE D'HISTOIRE NATURELLE, CHAUX-DE-FONDS, SWITZERLAND: MHNC 91.0136, “Kalukembé” [= Caluquembe, Huíla Province], collected by Albert Monard, 1932.
- NATURAL HISTORY MUSEUM, LONDON, UNITED KINGDOM: BMNH 1905.5.29.41, “Between Benguela and Bihe” [= between Benguela and Bié province, unknown locality], collected by William J. Ansorge, in 1904; BMNH 1961.1747, unknown locality, collector and collecting date.