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MERTENS, R. & H. WERMUTH, 1960. Die Amphibien und Reptilien Europas. Kramer Verlag, Frankfurt am Main.

SCHNEIDER, B., 1981. *Algyroides fitzingeri* (Wiegmann, 1834) — Tyrrhenische Kieleidechse. In: BÖHME, W. (ed.). Handbuch der Reptilien und Amphibien Europas. Band 1. Echsen I: 392-401. Akademische Verlagsgesellschaft, Wiesbaden.

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Atheris nitschei.

Photo: Walter Getreuer

Vipera ammodytes, "Sand Viper" – origin of its name, and a sand habitat in Greece

Henrik Bringsøe
Irisvej 8
DK-4600 Køge
Denmark
bringsoe@email.dk

Photos by the author

Close-up view of *Vipera ammodytes* from Achaia Feneos.

INTRODUCTION

Greece has a rich viperid representation of five species (JOGER & STÜMPEL, 2005). However, four of them have small and localised Greek distributions and are considered rare in Greece: *Vipera berus* in the northern mountains of the mainland, *Vipera graeca* in northern and central upland regions of the mainland, *Macrovipera schweizeri* in the Milos Archipelago (Western Cyclades), and *Montivipera xanthina* on the Eastern Aegean islands and in coastal Thrace.

The fifth species, *Vipera ammodytes,* is ubiquitous (BRINGSØE, 1986; HECKES et al., 2005; TRAPP, 2007) and basically forms a viperid landmark of Greece. Its popular name is either Sand Viper or Nose-horned Viper (ARNOLD, 2002; STUMPEL-RIENKS, 1992). The latter name is understandable considering the characteristic shape of its snout, which is turned upward in a prominent projection. Sand Viper seems rather a peculiar name for *V. ammodytes* as it rarely occurs in truly sandy habitats, although KREINER's (2007) and SCHLÜTER's (2009) statements about its absence from such environments are also incorrect, as I will demonstrate in this article.

As a guidance to habitat preference and other natural historical aspects of *V. ammodytes*, my field observations on that species on the Peloponnese from April 2008 are provided. Of particular relevance is one truly sandy habitat in a coastal region with a rich population.

I will also explore the nomenclatural facets of *V. ammodytes* in a historical context as the record behind well-established scientific names often dates much further back in time than what the formal authorship of the binomial names reveal. The oldest recognised binomial names date of course from 1758, i.e. Linné's *Systema naturae* (10th edition) which was, regrettably, very superficial in terms of herpetology. This paper hopes to illustrate that works several hundred years older may provide much more detailed information, both on the origin of scientific names as well as on species' habits and habitats. A number of these very old books and/or manuscripts have been digitally scanned over recent years, formatted in pdf, and are thus available to a much wider audience than previously when only a select happy few had access to library vaults.

NOMENCLATURAL HISTORY OF *VIPERA AMMODYTES*

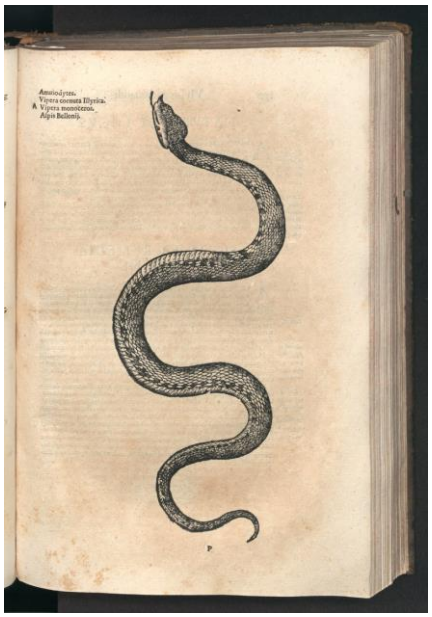
A. LINNÆUS (1758)

Two hundred and sixty-one years ago the foundations for the modern scheme of binomial nomenclature were laid by Swedish botanist, physician and zoologist Carl Linné (or Carl von Linné after his ennoblement, latinised as Carolus Linnæus or Carolus Linnaeus) in his work from 1758, *Systema Naturae*, having the full title *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Here the viper, at present known as *Vipera ammodytes*, was given the name *Coluber Ammodytes*. The original generic name *Coluber* is Latin and simply means "snake", whereas *ammodytes* has Greek origins as *ammos* means "sand", and *dutes* means "burrower" or "diver", in other words, the sand-diving snake. This meaning has already been explained in numerous publications, recently e.g. in LESCURE & LE GARFF (2006) and BODSON (2014).
Linné's diagnosis of the species was very brief: *Nasus terminatus verruca erecta*, which translates as Snout ended in an erect wart. Its range was also described briefly, but incorrectly: *Habitat in Oriente*, i.e. the Orient or the Middle East. He mentions a male, indicating that the description was based upon this specimen, however no further details were provided. The *epitheton specificum* (species name) "*Ammodytes*" was spelled with an initial capital letter, unlike our current standards. For instance for the genus *Coluber,* which he uses for 82 species of very diverse snakes, representing the current families of Colubridae, Homalopsidae, Lamprophiidae, Elapidae, Viperidae and Pythonidae, 38 species epithets have an initial capital letter whereas 44 have an initial lower case letter. He used rules of grammar for that purpose so that e.g. nouns (like *Ammodytes*, *Molurus* and *Situla*) are with an initial capital letter and adjectives (like *agilis*, *annulatus* and *vittatus*) are spelled with an initial lower case letter.
Coluber Ammodytes is not the only species with an incorrect geographical distribution. I would suggest that nearly half of them are wrong. I cannot say whether the explorers who collected animals abroad were to blame for being careless in providing correct geographical information for the specimens, or whether the researchers publishing new data should be blamed, or possibly both, or other persons handling the specimens. In general I find many of Linné's descriptions of reptiles and amphibians superficial or even misleading, and I am more impressed by some earlier works that I will mention below.

Linné conducted most of his activities in Sweden and he did not travel much abroad, only to northern and central Europe (MALMESTRÖM & UGGLA, 1957). He visited Denmark, Germany, England, France and The Netherlands, but, to my knowledge, never reached southeastern Europe or the south-eastern Alps that are inhabited by *V. ammodytes*. So he did not have any experience with that species in the wild.
In spite of Linné's status of being the father of modern taxonomy using binomial species names, Latin, latinised or scientific names were indeed well-known for numerous animals and plants hundreds of years before Linné wrote his important works. The alleged psammophilous habits of *V. ammodytes* date much further back in time.

B. ALDROVANDI (1639)

The scientific name of the Sand Viper was introduced much earlier than in Linné's *Systema Naturae*. The Italian professor of natural history Ulisse Aldrovandi described this snake in his work *Serpentum, et Draconum Historiae Libri Duo Bartholomaeus Ambrosinus* which was published in 1639, 34 years after his death, and reissued in 1640. The version currently available on the internet is from 1640. The viper was called Ammodite, see also ADLER (2007). Aldrovandi had established a museum in Bologna with an impressive



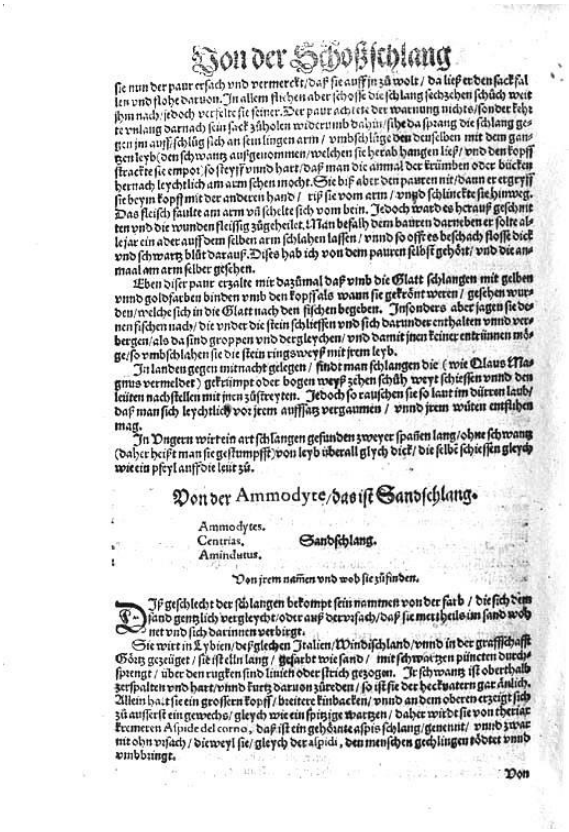
Ulisse Aldrovandi: *Serpentum, et Draconum Historiae Libri Duo Bartholomaeus Ambrosinus, page 169.*

specimen collection. He made numerous drawings of the specimens; woodcuts of these were made for his books. Page 169 is comprised of a full-page drawing of *V. ammodytes* which clearly depicts its characteristic "nose-horn", described as "Vipera cornuta Illyrica", i.e. horned viper from Dalmatia (see figure). Judging from the shape of the "horn", pointing obliquely forward, it fits well with the nominate subspecies which covers that range. His description is much more detailed and accurate than that of Linné. But occurrences in Italy and Libya are also mentioned, which is slightly confusing.
Aldrovandi's account of this viper, described as sand coloured, was again not the first, and referred to an even older work, that of Gessner.

C. GESSNER (1589)

The oldest source in which I found a description of *Vipera ammodytes* is by the Swiss naturalist and bibliographer Conrad Gessner from the 16th century. His famed work on zoology, *Historia Animalium* in five volumes, was published between 1551 and 1587 (ADLER, 1989). Volume five, *Serpentium Natura*, appeared in 1587. I have not been able to access the original Latin version. However, a German translation entitled *Thierbuch* was published and is now available on the Internet. The snake volume *Schlangenbüch* appeared in 1589. That was long after Gessner's death in 1565. The section on *V. ammodytes* was worded as follows:

"Von der Ammodyte/das ist Sandschlang
Ammodytes. Centrias. Amindatus. Sandschlang.
Von irem namen und woh sie züfinden.
Diß geschlecht der Schlangen bekompt sein nammen von der farb / die sich dem sand gentzlich vergleycht/oder auß der ursach/daß sie mertheils im sand wohnet und sich darinnen verbirgt. Sie wirt in Lybien/deßglechen Italien/Windischland/unnd in der graffschafft Görtz gezeüget / sie ist elln lang / gefarbt wie sand / mit schwartzen püncten durchsprengt / über den rugken sind linien oder strich gezogen. Ir schwantz ist oberhalb zerspalten und hart / unnd kurtz darvon züreden / so ist sie der hecknatern gar änlich. Allein hatt sie


Von der Schoßschlang

sie nun der paur ersach vnd vermerckt/daß sie auff jn zů wolt / da ließ er den sack fallen vnd flohe darvon. In allem fluchen aber sahe die schlang sechzehen schůch weit jhm nach/jedoch verfelte sie seiner. Der paur achtete der warnung nichts/sonder kehrte vmlang darnach sein sack zůholen widerumb dahin/sihe da sprang die schlang gegen jm auff/schlůg sich an sein lingen arm / vmbschlůge den denselben mit dem gantzen leyb/den schwantz aufgenommen/welchen sie herab hangen ließ/ vnd den kopff stracket sie empor/so steyff vnnd hart/daß man die aimal der krümben oder bůcken hernach leychtlich am arm sehen mocht. Sie biß aber den paurn nit/dann er ergreyff sie beym kopff mit der anderen hand / ziß sie vom arm / vnnd schlůcket sie hinweg. Das fleisch faulte am arm vñ schelte sich vom bein. Jedoch ward es herauß geschnitten vnd die wunden fleissig zůgeheilet. Man befalh dem bauren darneben er solte alle jar ein ader auff dem selben arm schlahen lassen / vnnd so offt es beschach flosse dick vnd schwartz blůt darauß. Diß hab ich von dem pauren selbst gehört/ vnd die anmaal am arm selber gesehen.
Eben diser paur erzalte mir dazůmal daß vnd die Glatt schlangen mit gelben vnnd goldfarben binden vmb den kopff als wann sie gekrönt weren / gesehen wurden/welche sich in die Glatt nach den fischen begeben. Insonders aber sagen sie des nachts fischen nach/ die vnder die stein schlieffen vnd sich darunder enthalten vnnd verbergen/als da sind groppen vnd dergleychen/ vnd damit jnen keiner entrünnen möge/so vmbschlahen sie die stein ringsweyß mit jrem leyb.
In landen gegen mitnacht gelegen / findt man schlangen die (wie Olaus Magnus vermeldet) gekrümpt oder bogen weyß zehen schůh weyt schiessen vnnd den leuten nachstellen mit jnen zůstreyten. Jedoch so rauschen sie so laut im dürren laub/ daß man sich leychtlich vor jrem auffsatz vergaumen / vnnd jrem wüten entfliehen mag.
In Dngern wirt ein art schlangen gefunden zweyer spannen lang/ohne schwantz (daher beißt man sie gestumpfft/von leyb überall gleych dick/ die selbe schiessen gleych wie ein pfeyl auff die leut zů.

Von der Ammodyte/das ist Sandschlang.

Ammodytes.
Centrias, Sandschlang.
Amindatus.

Von irem nammen vnd woh sie zůfinden.

Diß geschlecht der schlangen bekompt sein nammen von der farb / die sich dem sand gentzlich vergleycht/oder auß der vrsach/daß sie mertheils im sand wohnet vnd sich darinnen verbirgt.
Sie wirt in Lybien/deßglechen Italien/Windischland/vnnd in der graffschafft Görtz gezeüget / sie ist elln lang / gefarbt wie sand / mit schwartzen püncten durchsprengt / über den rugken sind linien oder strich gezogen. Ir schwantz ist oberthalb zerspalten vnd hart/vnnd kurtz darvon züreden / so ist sie der heckatern gar änlich. Allein hat sie ein grossern kopff / breitere kinbacken/ vnnd an dem oberen erzeigt sich zů ausserst ein gewechs/ gleych wie ein spitzige wartzen / daher wirdt sie von theriac kremeren Aspide del corno, daß ist ein gehörnte aspis schlang/genennt/ vnnd zwar nit ohn vrsach/ dieweyl sie/ gleych der aspidi, den menschen geschlingen tödtet vnnd vmbbringt.

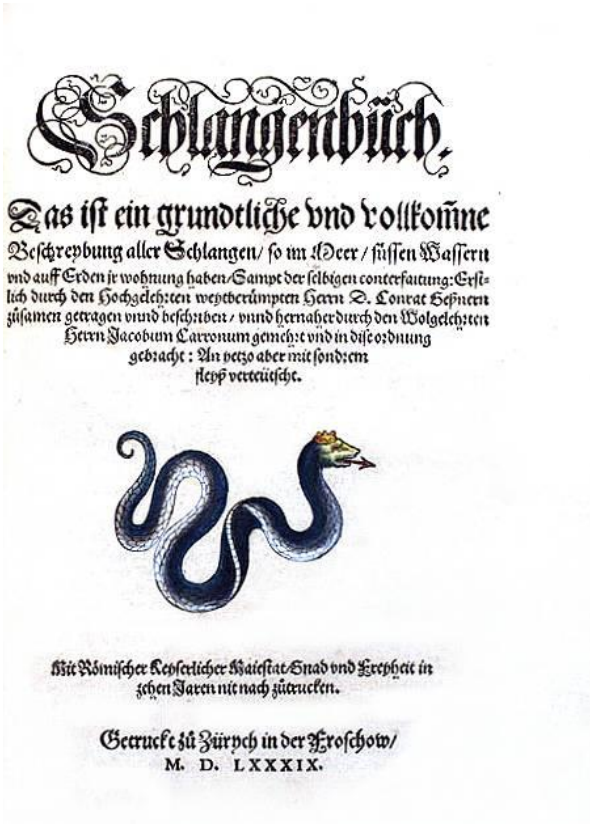
Von

GESSNER's (1589) text from Historia Animalium, volume five, Serpentium Natura.

ein grossern kopff breitere kinbacken / unnd an dem oberen erzeigt sich zu ausserst ein gewechs / gleych wie ein spitzige wartzen / daher wirdt sie von theriac kremeren Aspide del corno, daß ist ein gehörnte aspis schlang/ genennt/ unnd zwar nit ohn ursach / dieweyl sie/ gleych der aspidi, den menschen geschlingen tödtet unnd umbbringt."

Transcribed into current German:

"Von der Ammodyte/das ist die Sandschlange
Ammodytes. Centrias. Amindatus. Sandschlange.
Dieses Geschlecht der Schlangen bekommt seinen Namen durch die Farbe / die dem des Sandes völlig gleicht/oder dadurch/dass sie großenteils im Sand lebt und sich darin verbirgt. Sie wird für Libyen/desgleichen Italien/Windischland/und die Grafschaft Görz bezeugt / sie ist eine Elle lang / gefärbt wie Sand / schwarz gepunktet / über den Rücken sind Linien oder Striche gezogen. Ihr Schwanz ist oberhalb gespalten und hart / und kurz geschildert / so ist sie der Hecknatter sehr ähnlich. Sie hat allerdings einen



Woodcut drawing of *Vipera ammodytes*, i.e. the Ammodite, from Aldrovandi (1639) Serpentum, et Draconum Historiae Libri Duo Bartholomaeus Ambrosinus.

größeren Kopf / breitere Kiefer / und an dem oberen [Kiefer] befindet sich außen ein Gewächs / ähnlich einer spitzen Warze / daher wird sie von Theriakkrämer Aspide del corno, das ist eine gehörnte Aspisschlange/ genannt/ und zwar nicht ohne Grund / deswegen sie/ gleich der Aspidi, den Menschen durch ihren Umschlingen tötet und umbringt."

Translated into English:

"About the Ammodyte/that is the Sand Snake

Ammodytes. Centrias. Amindatus. Sand Snake.

This snake genus has been given its name because of the colour / which totally resembles that of the sand/or because / it generally lives in sand and hides itself there. It has been recorded from Libya/also from Italy/Windischland/and the county of Görz / it is one cubit long / coloured like sand / overlaid with black stippling / there are lines across the back. Its tail is divided on the upper side and hard / and characterised as short / thus very similar to the hedge snake. It has however a larger head / wider jaws / and there is a projection on the upper [jaw] / similar to a pointed wart / hence it is called Aspide del corno by snake-oil pedlars, that is a horned Asp Snake/ it is named/ and not without reason / therefore like the Aspidi, it kills by winding around humans."

Windischland is Slavonia, a historical region in eastern Croatia. The county of Görz is located in the south of Austria. Both regions are biogeographically logical. On the other hand, a misunderstanding must have caused the inclusion of Libya in its distribution.

The word Hecknatter ("hecknatern") is an old German expression meaning "hedge snake", which has been used for several snake species found in or near hedges (SCHMIDTLER, pers. comm.). In this case I find it likely that Gessner had a viperid species in mind, possibly even the current-day Hecknatter, *Vipera berus*. The words "theriac kremeren" took a longer time to decipher, both literally (the internet scan is of medium quality), and textually. Only when realising that theriac (or theriak) can mean a panacea, and kremeren most likely is the plural of Kramer (Krämer, or Hausierer, in current German, pedlars in British English) (IN DEN BOSCH, pers. comm.), it became clear that Gessner referred to hawkers selling wonder medicines, in this particular case most probably a form of snake oil or other snake derivative.

Aspide del corno is as relevant today as "Vipera dal corno" in Italian, as it was over four centuries ago (see e.g. STUMPEL-RIENKS, 1992).

It is unclear why it is mentioned that *V. ammodytes* "kills by winding around humans". Further down in Gessner's text details of its bite are provided, for instance that a victim will die within three hours after having been bitten. It may have been taken for granted that a lethal bite is also involved. Still, this seems a curious discrepancy. Checking Gessner's text on the Asp Viper, to which *Vipera ammodytes* is compared ("gleych der aspidi"), I did not find that action described for the asp snakes (however many forms are discussed), only venom was repeatedly mentioned. Thus, the action of killing is shrouded in uncertainty. It is possible that snakes, and especially deadly venomous species, were

Vipera ammodytes, nominate subspecies. It is characteristic that its nasal horn has an obliquely forward projection. Additionally the rostral is generally wider than high whereas it is approximately equally wide and high in *V. a. meridionalis*. This individual of *V. a. ammodytes* is a juvenile (SVL 25.0 cm, total length 28.6 cm) which was found near Paklenica in Croatia in October 2009.

attributed super-natural forces and could kill not only by direct venom injection through the fangs.

MORPHOLOGICAL DETAILS OF *VIPERA AMMODYTES*

As pointed out above, two popular names exist for this species: Sand Viper and Nose-horned Viper. Sandy habitats are exceptional for the species (see below), so Sand Viper is a fairly unsuitable name. Nose-horned Viper is a better choice. Within the genus *Vipera* it possesses by far the most distinct and prominent, but soft, 'nose-horn' with a length of up to 7 mm. It is covered by numerous small apical scales, normally ranging from 9 to 22, arranged in 3 (rarely 2 or 4) transverse rows. The upper tip of the rostral may reach the basal part of the horn. The direction of the nasal horn of *V. ammodytes* exhibits geographical variation.

In *V. a. meridionalis*, which occurs in Greece and Turkish Thrace, it is vertically erect whereas it has a distinct obliquely forward projection in the nominate subspecies distributed from the southeastern Alp area, through a major part of the Balkan peninsula but excluding Greece, Turkish Thrace, Bulgaria and southern Romania. I consider the Central Asian and Middle East taxon *transcaucasiana* a subspecies of *V. ammodytes* in accordance with URSENBACHER et al. (2007), even though some authors treat it as a distinct species. *Vipera latastei* and *Vipera monticola*, two West Mediterranean species, also have snout projections; however, their 'horn' is considerably smaller, up to 2 mm. It has the shape of a lobe. The scalation of the horn is also different in the two species groups. *V. latastei* and *V. monticola* have a very long rostral that covers most of the anterior part of the horn, which has merely 3-7 apicals.

In a third European viper, *Vipera aspis*, fairly widespread in southwestern and southern-central Europe, the tip of the snout is slightly but distinctly upturned, but its nature is far from horn-like as in *V. ammodytes*.

FIELD TRIP TO THE PELOPONNESE, APRIL 2008

When I observed vipers in Greece, I was reminded that one of the common names for *Vipera ammodytes,* Sand Viper, had been challenged before in the literature (e.g. KREINER, 2007). One goal of this paper is to communicate observations on an atypical sandy habitat in the north-western Peloponnese in April 2008. Data on a typical hilly and rocky habitat for *V. ammodytes* on the northern Peloponnese from the same trip is also included, as is brief information on a road record in the western Peloponnese.

Map of the Peloponnese showing the three localities where *Vipera ammodytes* was found during the 2008 trip. Numbers refer to the same localities as the text: 1 = vicinity of Achaia Feneos (Kalivia) in the Feneos basin, 2 = Strofilia forest, 3 = between Hora and Gialova.

The facts are presented in chronological order and then used to seek a connection between the ancient descriptions and current field observations.

Habitat 1. Feneos basin, northern Peloponnese – 19-20 April 2008

The Feneos basin is a fertile area with diverse and rich herpetofaunas, mainly reptiles (MAYER et al., 1990; MAYER & BEYERLEIN, 1999).

I have visited the area of macchie around Achaia Feneos (Kalivia) on several occasions and have observed a wide variety of reptile species. Today the area is highly dominated by intensive agriculture of the true basin or valley where I recorded only a few reptiles and amphibians. Hence my efforts concentrated on the hilly and rocky slopes close to the town of Achaia Feneos (until recently officially named Kalivia), at an altitude of 770 m. At approx. 10 o'clock on April 20, I noticed one female *V. ammodytes* that was well hidden on the ground inside a dense scrub of macchie. As I was passing by, I just managed to get a glimpse of the viper's head through the green leaves as the snake had found a small spot for basking, but only the anterior part of the snake was in the sun. The snake was very calm and remained motionless as we photographed its front part. Even as I carefully moved overlying branches with leaves to get better photos at a closer

The *Vipera ammodytes* from Achaia Feneos exactly as it was found, partly hidden inside dense scrub of macchie. Only the head and anterior part of the body were visible and directly exposed to sun.

distance, it did not stir at all. Subsequently we moved the viper a few metres to an open place for better shots, where it remained calm.
This individual was the only *V. ammodytes* found at the Achaia Feneos locality during my four spring visits, i.e. in April 1995, April 2001, April 2005, and April 2008. At these occasions the following species were recorded:
Bufo viridis, *Testudo hermanni*, *Testudo marginata*, *Mediodactylus kotschyi*, *Anguis cephallonica*, *Pseudopus apodus*, *Algyroides moreoticus*, *Lacerta trilineata*, *Podarcis peloponnesiacus*, *Ablepharus kitaibelii*, *Ophiomorus punctatissimus*, *Xerotyphlops vermicularis*, *Hierophis gemonensis*, *Platyceps najadum*, *Telescopus fallax*, *Zamenis situla*, *Malpolon insignitus*, *Natrix natrix*, and *Vipera ammodytes*.
I consider all these species syntopic with *V. ammodytes* and not just sympatric. *P. apodus*, *X. vermicularis*, *H. gemonensis*, and *T. fallax* were not recorded in the mapping survey of the entire Feneos basin carried out by MAYER et al. (1990). However, they were expected, considering their wide-spread distribution on the Peloponnese (BRINGSØE, 1986; TRAPP, 2007).

Habitat 2. Strofilia forest, northwestern Peloponnese – 21-22 April 2008

The Strofilia forest is part of a unique natural habitat in the sandy coastal zone of the northwestern Peloponnese, which is strictly protected at an international level. It is a very important forest of *Pinus pinea* (Umbrella Pine), along with lagoon and dune habitats. The altitude is close to sea level, at most reaching 20 m above sea level. I visited the Strofilia forest and the adjacent Kalogria lagoon four times, i.e. April 1985, April 1994, April 1995, and April 2008, and observed a rich herpetofauna (BRINGSØE, 1986, 2004; JØRGENSEN, 1995).
Already in 1994 we noticed that *V. ammodytes* is not strictly connected to dry habitats as one individual was found in a moist to swampy microhabitat merely some two metres from one of the numerous ponds (JØRGENSEN, 1995). However, this moist area was close to the drier sandy soil of the forest. To my knowledge *V. ammodytes* from a swampy habitat (in southwestern Greece) was only reported once before (BIELLA, 1983).
On 21 April 2008 we observed four *V. ammodytes* in the relatively open forest (see figure). Most of the forest floor was shaded, but there were some open spots suitable for basking. It is normal that there are abundant shrubs with spiny branches, and many big rocks found in *V. ammodytes* habitats.
But that is certainly not the case in the Strofilia forest. There is indeed quite dense undergrowth of shrubs in the forest, but it is not spiny and there are basically no rocks. I presume that this habitat offers less favourable hiding places than normal *V. ammodytes* habitats, but still the species is common here. Possibly the conditions are suboptimal for its predators.

During our four visits to the Strofilia forest (including the adjacent Kalogria lagoon and coastal dunes) the following species of amphibians and reptiles have been recorded:
Lissotriton graecus (sympatric), *Pelophylax epeiroticus* (sympatric), *Pelophylax kurtmuelleri* (sympatric), *Bufo viridis,* (syntopic), *Hyla arborea* (sympatric), *Emys orbicularis* (sympatric), *Mauremys rivulata* (sympatric), *Testudo hermanni* (syntopic), *Testudo*

The Strofilia forest on the northwestern Peloponnese, habitat of *Vipera ammodytes*.

A vividly coloured adult *Vipera ammodytes* in the Strofilia forest.

marginata (sympatric), *Lacerta trilineata* (syntopic), *Podarcis ionicus* (syntopic), *Ablepharus kitaibelii* (syntopic), *Elaphe quatuorlineata* (syntopic), *Natrix natrix* (sympatric), *Natrix tessellata* (sympatric), and *Vipera ammodytes*.

I have indicated for each of the 15 species whether I consider them to be syntopic with *V. ammodytes* or merely sympatric. Those that are sympatric may not often occur in close proximity to vipers as they generally have different habitat requirements.

Habitat 3. Between Hora and Gialova, SW Peloponnese – 22 April 2008

The last locality from our trip was inspected very superficially, but it illustrates yet another typical way of finding this viper. The observation took place on a main road in a suburban and agricultural area. We saw one viper (adult male) on the asphalt road as we were driving in the afternoon. We were 7 km south of Hora and 7 km north of Gialova. We moved the individual further into an olive grove, a few hundred metres away from houses and habitation where we photographed it (see figure). Afterwards we carried the snake a bit further away from the houses and released it. We made no attempts to find further reptiles.

It is typical for *V. ammodytes* to be found on roads, though there may be substantial traffic of motor vehicles and the species also occurs close to villages and other human activities. In many cases vipers (and other snakes) are found dead on the roads, either run over by cars (probably often killed deliberately), or killed by humans by other means. See also BRINGSØE (1986, 1995). Even though these latter observations date more than one third and one fourth of a century back in time, it is my impression that the attitude to snakes among Greek people has not changed significantly.

DISCUSSION

The origin of scientific names is often worth investigating, especially when it seems illogical or based on misunderstandings or wrong information. That is indeed the case for *Vipera ammodytes* as its sand-dwelling behaviour is the exception for this snake species.

Vipera ammodytes found on a road on the western Peloponnese, photographed in a typical defensive posture.

The official author of the binomial name, LINNÆUS (1758), was not of much help in elucidating this riddle as its alleged psammophilous habits date much further back in time. ALDROVANDI's (1639) description of the Ammodite as *Vipera cornuta Illyrica* may possibly explain the mistake of including Libya, in North Africa, in its distribution. Had Aldrovandi confused it with *Cerastes cerastes,* which also possesses upward horn-like projections and which is common in Libya? The horns of *C. cerastes* are fundamentally very different from that of *V. ammodytes*, but there are major superficial similarities between them, which, in my opinion, make confusion possible or even likely.

The erroneous inclusion of Libya in the distribution of *V. ammodytes* probably stems from GESSNER (1589). Since the origin of this snake's common name was associated with a coloration resembling sand and an alleged habit of digging in sand, *V. ammodytes* may also have been confused with another member of the genus *Cerastes*, namely the sand-dwelling (but "hornless") *Cerastes vipera,* which lives in Libya.

GESSNER (1589) already identified the genus *Cerastes* under a group of venomous snakes from North Africa and the Middle East in an eight-page chapter "Von der Aspis Schlangen" ("On the Asp Snakes"), mainly dealing with their venom and deadliness. Additionally *Naja haie* was apparently included in that group as well (perhaps a venom-spitting species as indicated in the text). LINNÆUS (1758) made separate entries for *Cerastes vipera* (named *Coluber Vipera*, Habitat in Ægypto) and *Cerastes cerastes* (named *Coluber Cerastes*, Habitat in Oriente). Moreover, he treated *Vipera aspis* as well (named *Coluber Aspis*, Habitat in Gallia). On that basis I am not in a position to explain why *Vipera ammodytes* was described as being sand-dwelling and occurring in North Africa.

It is hard to say precisely why such errors occur in old natural history works. The fact that the authors rarely had the opportunity to study exotic animals in the wild would inevitably have been an important source of error as information had to be passed

on from several people starting with local collectors in remote regions. Fieldwork was probably uncommon among those authors describing animals from museum collections. Specifically, mistakes and misunderstandings made by GESSNER (1589) might have been echoed uncritically by ALDROVANDI (1639), and consequently ALDROVANDI's (1639) errors were likely carried over by LINNÆUS (1758).

In conclusion, linking natural history observations of today to the above-mentioned historical accounts is a natural process despite a nearly half a millennium time gap. Moreover, pre-Linnaean works may be very relevant for many well-established taxa, as these will often provide detailed original information (cf. ADLER (1989, 2007)). But, as illustrated in this paper, we need to evaluate such information critically and sceptically. The *Systema naturae* is shallow in many ways, albeit pioneering in its introduction of binomial nomenclature. As indicated by its title, it is basically just a system of nature that has, nevertheless, proved a tremendously important tool for current standards in nomenclature and systematics. However, I would say, at least in terms of herpetology, this system is by far the most important element of the work, as unfortunately the descriptive parts are quite incomplete compared to earlier works. Several earlier works are now becoming available online, and it is very worthwhile to make use of these previously almost inaccessible works. We may expect more to come on the Internet in the future.

In their review of available habitat data for *V. ammodytes*, HECKES et al. (2005) provided several examples of occurrences on sandy substrate: a forest with sandy substrate near Istanbul, as well as sandy beaches on Mykonos and Ios (the Cyclades). Our initial observation of *V. ammodytes* in a swampy area of the Strofilia forest in 1995 should not be overinterpreted, as it was in close proximity to the 'ordinary' forest on dry substrate; the snake might have been hunting hydrophilous prey. An earlier observation of *V. ammodytes* near Lake Stimfalia (BRINGSØE, 1986) gave me the same impression. According to TRAPP (2007) very moist habitats are avoided by this snake. The first two habitats (Feneos basin and Strofilia forest) are very different and both of them are characterised by high numbers of reptiles and amphibians occurring in several different microhabitats though the above-mentioned species lists are probably fragmentary. These observations, linked with detailed published descriptions (HECKES et al. 2005; TRAPP 2007), illustrate that *V. ammodytes* is a generalist in terms of habitat selection. On that basis it is considered natural that this species may also go to extremes so that sandy environments can be inhabited occasionally.

SUMMARY

The scientific name *Vipera ammodytes* would indicate that this viper is typically sand-dwelling but the reality is that this habitat is unusual for the species. Though it was formally described by LINNÆUS (1758), earlier works portrayed the species in much more detail and explained the curious name. In this context the works of ALDROVANDI (1639) and GESSNER (1589) are discussed. However, they erroneously included Libya in its distribution. That mistaken information might have been caused by confusion with the genus *Cerastes,* which can possess upward horn-like projections although not on the snout (*C. cerastes*), and may live in sandy habitats (*C. vipera*). However, members of *Cerastes* had already been described in separate entries, so the background for the misinformation cannot be fully explained. Even though GESSNER's (1589) *Historia Animalium* was published nearly half a millennium ago, it is still relevant to link his observations with current field studies.
From a trip to the Peloponnese in April 2008, observations on *V. ammodytes* were made at three localities. The first (Achaia Feneos, northern Peloponnese) being a typical macchie habitat whereas the second (Strofilia, northwestern Peloponnese) was formed by a sandy forest habitat. In the third case one individual was found on a main road on the southwestern Peloponnese. In terms of habitat selection, *V. ammodytes* is a true habitat generalist occurring in a wide range of habitats, also exceptionally in fully sandy habitats.

SAMENVATTING

De wetenschappelijke naam *Vipera ammodytes* zou kunnen doen vermoeden dat deze adder zandige gebieden bewoont. maar dat is echt uitzonderlijk voor de soort. De slang werd formeel beschreven door LINNÆUS (1758), maar oudere werken (ALDROVANDI, 1639; GESSNER, 1589) karakteriseerden haar al gedetailleerder en verklaarden de opmerkelijke naam afdoende. Niettemin, deze auteurs meenden dat de slang ook in Libië in Noord-Afrika voorkwam. Dit kan zijn ten gevolge van verwarring met het genus *Cerastes* waarvan vertegenwoordigers ook hoorntjes op de kop (maar niet op de snuitpunt) kunnen hebben (*C. cerastes*), en die in een zandige leefomgeving voor kunnen komen (*C. vipera*). Echter, vertegenwoordigers van het genus *Cerastes* werden door de genoemde auteurs al onder aparte trefwoorden behandeld, zodat de verwarring toch niet geheel verklaard kan worden. Het is opmerkelijk dat GESSNER's (1589) *Historia Animalium,* weliswaar haast vijf eeuwen geleden gepubliceerd, nog steeds zinnig in verband gebracht kan worden met huidige veldstudies.

Tijdens een uitstapje naar de Peloponnesos in April 2008, namen we *V. ammodytes* waar op drie verschillende plekken. De eerste (Achaia Feneos, in het noorden van de Peloponnesos) was een typisch macchia habitat, terwijl het tweede (Strofilia, noordwestelijke Peloponnesos) een zandig bosgebied was. Het derde geval betrof een individu gevonden op een hoofdweg in het zuidwestelijk deel van de Peloponnesos. *Vipera ammodytes* is feitelijk een echte habitatgeneralist die in vele typen terrein kan leven, bij uitzondering zelfs in volledig zandige gebieden.

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Dalmatolacerta oxycephala (Squamata: Lacertidae) eating a stink bug on the island of Cres, Croatia, along with other ecological notes

Henrik Bringsøe
Irisvej 8
DK-4600 Køge
Denmark
bringsoe@email.dk

INTRODUCTION

The distribution of *Dalmatolacerta oxycephala* (SCHLEGEL, 1839), the Sharp-snouted Rock Lizard, is restricted to the east Adriatic coastal area from southern Croatia through southern Bosnia**,** Herzegovina**,** and Montenegro to northern Albania (BISCHOFF, 1984; ŠUNJE et al., 2015; SPEYBROECK et al., 2016). In 2006, a population in Osor on the island of Cres was reported (TÓTH et al., 2006); the first observation was made by Tóth on 26 April 2005 as three individuals were photographed (Tóth pers. com.**,** 2016). This northwestern expansion, by approx. 200 km, has almost certainly been caused by an anthropogenic introduction. Currently the herpetofauna of the islands Cres and Lošinj and the adjacent islets are surveyed regularly (TÓTH et al., 2017).

OBSERVATIONS

On 14-15 August 2016 I visited the old town of Osor, situated on the southwestern coast of the island Cres in Croatia, to observe *Dalmatolacerta oxycephala*. This species was most commonly seen on the old walls of Osor. The lizards were active throughout the entire day and proved to be not particularly shy, even during the afternoon of 14 August which was hot with air temperatures of 30-31ºC. However, in these high temperatures the lizards were usually observed in shaded parts of the walls.

On 14 August at 13:25-13:30 one adult *D. oxycephala* was observed eating an insect on the town square of Osor (coordinates 44° 41'37" N, 14° 23'34" E, altitude 3 m above sea level). But after a few seconds the lizard ran into a small crevice in the shade. From there I could see that the lizard chewed and swallowed the insect, but I was unable to photograph the final part of ingestion. The photo shows that the insect was an imago of a green species of stink bug (or shield bug) of the family Pentatomidae (Hemiptera). Unfortunately, it proved impossible to identify it to species or genus level (det. Aukema, pers. com.**,** 2016, Damgaard pers. com.**,** 2016). According to ALDRICH (1988) stink bugs of Pentatomidae have highly developed dorsal abdominal scent glands and metathoracic scent glands. One important function of the scent glands is to serve as a defense against predators such as lizards. Thus, it is noteworthy that *D. oxycephala* was recorded eating a stink bug. These feeding habits may not be unusual for *D. oxycephala*.

DIET

HENLE (1985) investigated 15 faecal samples of *D. oxycephala* from Otok Katić near Buljarica in Montenegro. Remains of Coleoptera (beetles) were most common. Moreover Isopoda, Dermaptera, Hemiptera (in his paper called Rhynchota, which is an old name for

Adult *Dalmatolacerta oxycephala* eating a stink bug of the family Pentatomidae in the old town of Osor on 14 August 2016.

Photo: Henrik Bringsøe.

that order), Hymenoptera, Lepidoptera (larva) and Diptera were found. As to the true bugs, Hemiptera, it is mentioned that there were three pieces of bug, though only identified to order level. However, HENLE (1985) mentioned that most of the faecal mass proved unidentifiable. Summarizing the diet of *D. oxycephala* on the Croatian island Vis, GRBAC et al. (1998) reported that *D. oxycephala* mainly eats Coleoptera and to a lesser extent Hymenoptera, Araneae and Homoptera. Previously bugs of Homoptera (though not comprising Pentatomidae) were ranked as suborder of the order Hemiptera, nevertheless, it is not considered to be monophyletic (VON DOHLEN & MORAN, 1995).

An unusual prey item was observed by WIEDEMANN (1909) who saw a *D. oxycephala* with a scorpion in its mouth as it was running into a rock crevice. The scorpion was described as “medium-sized”, but no further details were provided. I find it likely that it belonged to the genus *Euscorpius,* which comprises comparatively small and fairly harmless scorpions as they are the most common species within the geographical range of *D. oxycephala* (KALTSAS et al., 2008). An even more peculiar case was reported by ZIMIĆ & JELIĆ (2014) who observed a large centipede of the species *Scolopendra cingulata* attacking and killing an adult *D. oxycephala*. The authors speculated that either the centipede had directly attacked the lizard or the lizard had unsuccessfully attacked the centipede. Nevertheless, it is assumed that the lizard had underestimated the power of the centipede.

A picture emerges of *D. oxycephala* eating a wide variety of invertebrates, even some which are often avoided by small and medium-sized lacertids (centipedes, scorpions and bugs). Fruit is also eaten, e.g., RICHTER & RICHTER (1991) observed *D. oxycephala* eating overripe grapes in a monastery garden on the island Mljet in southern Croatia.

OTHER OBSERVATIONS

During my search I found *D. oxycephala* to be common throughout Osor. I saw roughly 25-30 individuals. Apparently it is now well-established there. This contrasts with the

observations of SÄMANN & ZAUNER (2010) who saw only six or seven adults (plus some juveniles) on each of two observation days in May 2009 and June 2010 respectively.
I also searched for lizards on the natural rock formations just outside Osor, but only found *Podarcis melisellensis*. A narrow channel (8-11 m wide) separates Cres from the nearby island of Lošinj. As I investigated the wall towards the channel on the Lošinj side, I also only found *P. melisellensis*. My observations agree with SÄMANN & ZAUNER (2010) and ŠUNJE et al. (2015) who were also unsuccessful as they searched for *D. oxycephala* outside the old walls of Osor. Considering that the habitats of *D. oxycephala* generally consist of larger rock formations with deep crevices and man-made walls, often dry and lacking vegetation (BISCHOFF, 1984; HENLE, 1985; ŠUNJE et al., 2015), it is an open question whether this species will ever manage to spread from Osor into the surrounding natural habitats or to Lošinj.

According to BISCHOFF (1984) *D. oxycephala* is a very shy lizard. This statement contradicts my personal observations as I often went close to these lizards in Osor, despite the high air temperatures. In a number of cases (about 50% as a rough estimate) I could carefully move to a distance of approx. 80-100 cm in order to photograph them. Schweiger (pers. com., 2016) confirms that *D. oxycephala* is not at all shy at Osor and that the same trend is seen at the city wall of Kotor, and slightly less pronounced at the city wall of Dubrovnik (In den Bosch, pers. com., 2019), whereas the lizards are very shy in wild habitats away from humans. Apparently this species may readily get used to the presence of many people and exhibit minimal skittishness.
It is worth noting that the Sharp-snouted Rock Lizard itself also serves as prey for other organisms. E.g. on 14 August I photographed one semi-adult *Hierophis gemonensis* with a total length estimated to 60 cm in a wall inhabited by *D. oxycephala*. Some tongue-flicking was noticed and the snake was probably hunting *D. oxycephala* as prey. The location was approx. 50 m southwest of the town square of Osor (see above).

SUMMARY

During a visit to Osor on the island Cres, Croatia, in mid August 2016 I photographed one adult *Dalmatolacerta oxycephala* eating a stink bug of the (family Pentatomidae). Judging from the pertinent literature it is concluded that *D. oxycephala* eats a wide variety of invertebrates, including scorpions, beetles and possibly even centipedes. Ripe fruit is also eaten. *D. oxycephala* is comfortable with humans at Osor and in other habitats visited frequently by people, whereas it proves very shy in other habitats. At Osor one *Hierophis gemonensis* was apparently hunting *D. oxycephala* in a wall.

SAMENVATTING

Tijdens een bezoek in augustus 2016 aan de stad Osor op het eiland Cres (Kroatië) fotografeerde ik een volwassen *Dalmatolacerta oxycephala* die een stinkwants at uit de familie Pentatomidae. De literatuur over *D. oxycephala* geeft aan dat de soort allerlei voedsel tot zich neemt, vooral kleinere ongewervelden zoals schorpioenen, kevers, wantsachtigen en mogelijk zelfs grote duizendpoten. Ook rijp fruit staat op het menu. Op plekken waar regelmatig mensen komen, is deze hagedis weinig schuw; voelt zich daarentegen sneller verstoord op andere plaatsen. Te Osor bleek dat de soort waarschijnlijk ook zelf een prooi is want ik zag de slang *Hierophis gemonensis* achter deze hagedis aangaan in een muur.

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Envenomation effects of a snakebite by the Great Lakes Bushviper, *Atheris nitschei* Tornier 1902, from Kivu, Zaire in April 1981, with notes on its venom and other bites

Van Wallach
4 Potter Park
Cambridge, MA 02138
USA
serpentes1@comcast.net

INTRODUCTION

The tropical Central African bush vipers of the genus *Atheris* are comprised of 16 small, arboreal species that extend from Guinea to Uganda, southward to the Democratic Republic of the Congo and Mozambique (McDiarmid et al., 1999; Wallach et al., 2014; Spawls et al., 2018). Eight of the species are rare and another six species have small distributions; only *A. chlorechis* of West Africa and *A. squamigera* of Central Africa have large ranges (Dobiey & Vogel, 2007; Chippaux & Jackson, 2019).

One species from the easternmost part of the generic range, *Atheris nitschei* Tornier (1902), commonly known as Nitschei's Bushviper, Great Lakes Bushviper, and Sedge Bushviper, inhabits mountains of the Albertine Rift of East Africa, a north-south strip in the easternmost Democratic Republic of the Congo (E. Nord-Kivu, E. Sud-Kivu and N.E. Katanga provinces), southwestern Uganda (Bushenyi, Kabale, Kabarole, Kanungu, Kasese, Kisoro, Ntungamo and Rukungiri districts), Rwanda (Eastern, Northern and Western provinces), and western Burundi (Bururi , Muramvya and Mwaro province) (Broadley, 1998; Mallow et al., 2003; Dobiey & Vogel, 2007; O'Shea, 2018; Spawls & Branch, 2020). It may be a common species where it lives but is not often encountered as it inhabits highlands from 1600–2800 m, is arboreal and nocturnal in behaviour, and occurs in limited regions (Pitman, 1974).

Distribution map of *Atheris nitschei* (from Phelps, 2010).

No specific antivenom or antivenin is produced for any species or subspecies of *Atheris*, and *A. nitschei* venom is expensive, selling for $1,852/g (SA Venom Suppliers, South Africa), $2,100/g (Latoxan Laboratory, France), $2,464/g (Mayflower Bioscience, USA), $4,000/g (MToxins Venom Lab, Canada), and $10,014/g (Lucerna-Chem, Switzerland).

Among all species of the genus *Atheris*, only a single fatality is known and that resulted from the bite of a large (71 cm length overall) *Atheris squamigera* specimen. The victim was a 37 year old male in Central African Republic who was bitten on his right shin on 20 August 1986. He was admitted to a hospital but could not be saved. He experienced massive swelling of his right foot, calf and thigh and his blood was unable to clot after one hour's time. On day 5 he vomited blood, his blood pressure suddenly dropped to 40/20, and he went into shock from which he never recovered, dying the following day (LANOIE & BRANCH, 1991). Symptoms of envenomation by *Atheris squamigera* include, in addition to edema, haemorrhage, and pain, the following: nausea, vomiting, diarrhea, drowsiness, and impaired breathing. Laboratory studies indicate that afibrinogenemia (lack of fibrinogen) and thrombocytopenia (low thrombocyte count) in the blood are the main results of envenomation (MEBS *et al.*, 1998).

Atheris chlorechis.

Photo: Walter Getreuer

A serious bite from *A. chlorechis* on a 26 year old male in The Netherlands was treated in a hospital setting and blood parameters were studies, showing that he suffered from acute renal failure (which normalized after three weeks) and massive blood loss (5 liters in first 6 hours). Antivenin treatment began 12 hours after the bite and the victim then recovered. Haemoglobin levels dropped from 9.4 to 4.0 mmol/l after one day, platelet counts from 128 to $19x10^9$/l after 5 days; fibrinogen normalized after 5 days and platelets normalized after two weeks. Lactate dehydrogenase (LDH) values, which indicate intravascular haemolysis, increased from 267 to 1050 after day 1 and maxed out on day 5 at 5750 (TOP *et al.*, 2006).

Records exist for a half-dozen bites by *A. nitschei*, none of which were fatal. CHIFUNDERA (1990) included *A. nitschei* bites as Category II, inflicting serious effects such as local necrosis. WHO (2017) classified *Atheris* venom as Category 2 (secondary medical importance), capable of causing morbidity, disability or death. *Atheris* venom is known to be haemotoxic, causing severe pain, inability to clot blood, and destruction of red blood cells. The present account represents the first experienced but seventh published snakebite by *A. nitschei*. A synopsis of the experience was reported by SHOUMATOFF (1986: 213–216).

CASE DESCRIPTION

This snakebite occurred while I was on a trip while studying the snake collection of the old Belgian Congo Central African Research Institute (IRSAC – Institut de Recherche Scientifique de Afrique Central) in Lwiro (Kivu, Zaire, now D.R.C.), where Laurent deposited much of his Congolese material, and travelling to Kisangani to catch the riverboat for the 10-day, 1600 km trip down the Congo River to Kinshasa. Ten live *Atheris nitschei* were collected/purchased from the vicinity of Lwiro (elev. 1600 m) during March and April, 1981. My age was 34, my weight 69 kg, and my height 1.7 m. I was bitten while in Kisangani awaiting the arrival of the boat for Kinshasa. An exchange of three *A. nitschei* was brokered with the director of the local zoo for a beautiful adult Rhinoceros Viper (*Bitis nasicornis*) and in the process of hurriedly removing three snakes from their bag, I was accidentally bitten by an adult individual of unknown gender ca. 50 cm in length. Up to that point the snakes had been docile and freely handled.

day / affected body parts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
middle and index finger	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
other fingers and palm	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3										
back of hand	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3																						
inner forearm	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3																			
outer forearm	1	1	1	1	1	1	1	1	2	2	2	3	3																										
biceps	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3																					
triceps	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3																						
deltoid			1	1	1	1	1	1	2	2	2	2	2	3	3	3	3																						
neck			1	1	1	1	1	1	1	2	2	2	3	3																									
pectoralis+latissimus dorsi			1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3																			
rectus abdominis					1	1	1	2	2																															
internal+external obliques					1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3														
trapezius					2	2	2	2	2	3	3	3	3	3																									
kidneys						1	1	1	1	1	1	1																											
radial and ulnar nerves						1	1	1	1	1	1	1																											
humeral nerve	1	1	1	1	1	1	1	1	2	2	2	3	3	3																									

Table 1. Chart of intensity of swelling in affected regions over first 6 weeks (1 = strong, 2 = moderate, 3 = mild).

day / affected body parts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
middle and index finger	1	1	1	1	1	1	2	2	2	2	2	3	3	3																									
other fingers and palm																																							
back of hand	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3																					
inner forearm		1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
outer forearm		1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
biceps			1	1	1	1	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
triceps			1	1	1	1	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
deltoid			1	1	1	1	1	1	2	2	2	3	3	3																									
neck				1	1	1	2	2	2	3	3	3	3	3																									
pectoralis+latissimus dorsi			1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3																			
rectus abdominis						1	1	1	2	2	2																													
internal+external obliques							1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3														
trapezius						2	2	2	2	2	3	3	3	3																									
kidneys					2	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3														
radial and ulnar nerves																																							
humeral nerve																																							

Table 2. Chart of intensity of stinging/burning sensation in affected regions over first 6 weeks (1 = excruciating, 2 = moderate, 3 = mild).

One may notice sometimes that there is not an exact correspondence between symptoms recorded in the text and the data in the tables since the tables were constructed at a later date based solely on my original notes (not my memory of events), perhaps less influenced by the effects experienced at the time.

day / affected body parts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
middle and index finger																																							
other fingers and palm																																							
back of hand																																							
inner forearm				1	1	1	1	1	2	2	2	3	3	3	3																								
outer forearm				1	1	1	1	1	2	2	2	3	3	3	3																								
biceps				1	1	1	1	1	2	2	2	3	3	3	3																								
triceps				1	1	1	1	1	2	2	2	3	3	3	3																								
deltoid				1	1	1	1	1	2	2	2	3	3	3	3																								
neck				1	1	1	2	2	2	3	3	3	3	3																								
pectoralis+latissimus dorsi			1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3																		
rectus abdominis							1	1	2	2	2																												
internal+external obliques							1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3													
trapezius						1	1	2	2	2	3	3	3	3																								
kidneys					2	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3													
radial and ulnar nerves						1	1	1	2	2	2	3	3	3	3																								
humeral nerve							1	1	2	2	2																												

Table 3. Chart of intensity of aching in affected regions over first 6 weeks (1 = excruciating, 2 = moderate, 3 = mild).

day / affected body parts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
middle and index finger							1	1	1	1	1	1	1	1	1	2	2	2	2																					
other fingers and palm					2	2	1	1	1	1	3	3	3	3	3																								
back of hand					2	2	1	1	1	1	1	3	3	3	3	3																							
inner forearm					1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3																	
outer forearm							1	1	1	1	1	1	2	2	3	3	3	3																				
biceps				1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	3																
triceps							1	1	1	1	2	2	2	2	2	3	3	3	3	3	3																
deltoid							1	1	1	1	2	2	2	3	3	3																				
neck																																						
pectoralis+latissimus dorsi										1	1	1	2	2	3	3																				
rectus abdominis						1	1	1	2	2	2																										
internal+external obliques						1	1	1	1	1	1	2	2	2																						
trapezius						2	2	2	2	2	3	3	3	3																						
kidneys			2	2	1	1	1	1	3	3	3																										
radial and ulnar nerves																																							
humeral nerve																																							

Table 4. Chart of intensity of hemorrhaging in affected regions over first 6 weeks (1 = excruciating, 2 = moderate, 3 = mild).

RESULTS

On 18 April 1981 at 16:00 hours (one hour before the closing of the zoo and expected exchange of specimens), while holding a bag with 10 adult *Atheris nitschei* in my right hand, I reached in with my left hand to extract three specimens and was bitten by a single individual on the index and middle fingers. Both fangs penetrated the skin but it

appeared that venom was only injected through one fang. The snake's left fang hit my index finger 1/3 of the way between the second knuckle and the finger's base while the right fang hit my middle finger midway between the knuckle and base. Automatically withdrawing my hand caused my fingers to spread apart, trapping the snake's fangs so that it could not release its hold on me. As I watched in mild shock for perhaps two seconds I saw the skin around the right fang swell up in a small nodule ca. 5–6 mm in diameter (the size of a green pea). Realizing that this was venom being injected subcutaneously, I quickly grabbed the snake and wrenched it free from my hand. An immediate stinging sensation was felt in both fingers, even though the left puncture site did not swell up. The following notes record my symptoms and observations of the bite over the following year. During the first three days the pain was so intense that I was unable to satisfactorily record my experiences and my remarks are based only on unintelligibly scribbled notes and my fragmented memory of events during those first days.

I was unable to make measurements for the first few days but comparison of measurements of the circumference (in cm) of my upper arm, forearm, hand and middle finger of the left side on day 5 after the bite (38.5, 34.5, 28.0 and 10.5) and the right side (26.0, 24.5, 23.5 and 7.0) shows that the limb increased ca. 1/3 in size (respectively, 32%, 29%, 16% and 33%). By day 9 the measurements were, respectively, 35.0, 31.0, 26.0 and 9.5 cm, showing an increase of only ca. ¼ of normal size (26%, 23%, 12%, 26%). There was no discolouration for the first three days and the puncture sites never discoloured. General effects included swelling extending along left half of upper body from neck to waist (and also calf and knee), fever, chills and diarrhea; tachycardia;

Atheris nitschei.

Photo: Walter Getreuer

vertigo, weakness, dizziness and faintness; numbness; orange and red urine along with painful kidneys; stomach muscles turning to jelly and a hard strap of tissue developing along inner arm; recurring pain along bones (nerves ?) of inner surface of forearm and upper arm. The only frightening aspect of the entire ordeal was the development of severe abdominal edema that lasted for four days, which scared me into thinking that the condition might be permanent. When I walked I had to hold tightly to my belly as I feared it might shake loose or end up separating my abdominal muscles from their attachments. I feared that my stomach might remain in its viscous condition, resulting in permanent damage. Likely it was a form of edema, fluid retention in body tissue, here perhaps in the skin on part of the abdomen?

Day 1 (18 April): (5 min.) both fingers swollen to bases; (15 min.) stinging, tingling, and radiation-like burning sensation spreading throughout hand; (25 min.) back of hand starting to swell, pain commencing along forearm; (35 min.) swelling beginning on palm of hand; (1 hr.) distal half of back of hand swollen to twice normal size, pain starting in armpit; (1 hr. 20 min.) ¾ of palm swollen; (1 hr. 40 min.) hand and wrist beginning to throb, terrible thirst and hunger developing; (4 hr.) incredibly intense burning pain in hand, vertigo and nausea commencing, when lying prone in bed I am all right but when sitting up or standing I experience tachycardia, weakness and faintness; (12 hr.) entire palm swollen with forearm starting to swell, no discolouration present.
Day 2 (19 April): (18 hr.) half of forearm swollen, afflicted area throbbing painfully, hand appears twice normal size with middle finger particularly expanded, all fingers swollen in slightly flexed position and absolutely immobile, only immersion in cold water provides temporary relief from burning sensation; (23 hr.) pain excruciating, ¾ of forearm swollen, lymph nodes in armpit very painful, able to rotate hand at wrist about 20°; (25 hr.) swelling reaches elbow, pain terrible, no haemorrhage visible yet, extreme effort required to walk more than a few meters, when attempting to get a drink of water or go to the toilet I could only take a couple steps before having to kneel or lie down and recuperate before trying another few steps, incredibly weak, faint and dizzy.
Day 3 (20 April): (30–38 hr.) arm pain unrelenting during night, preventing sleep, whenever I entered a semiconscious state preparing to doze off the pain would bring me back quite awake again, after fatigue made me drowsy once again I would awaken with pain before falling asleep, a cycle that continued throughout the night; (39 hr.) swelling reaching shoulder and starting down the muscle *latissimus dorsi*, intense pain all along arm and hand, being sensitive to slightest pressure, lymph nodes in armpit swollen, foream turning reddish-purple; (44 hr.) urine bright orange, vertigo and tachycardia continue whenever I stand up, prickling ‘pins and needles’ sensation all over affected area; (46 hr.) entire *latissimus dorsi* swollen and *pectoralis major* beginning to swell up, wrist entirely immobile; (50 hr.) swelling commencing up base of neck, ½ of the muscle *pectoralis major* swollen, lymph node pain in armpit diminishing; (51 hr.) at urging of hotel staff, enter Kisangani hospital (19:00 hours) and am given two aspirin and a valium, prescription written for (1) procaine penicillin, (2) streptomycin, (3) Novalgine, and (4) Tanderil but unable to fill as pharmacies in town closed, difficulty in breathing over next 3–4 hours before finally falling asleep (felt as if there was a constriction around my chest and I couldn’t get enough oxygen even though I was breathing deeply).
Day 4 (21 April): (62 hr.) slept fitfully for entire night (fist real rest since being bitten), waking with a sore lower back from soft, saggy hospital bed, extremely difficult to find a comfortable position, arm swollen in immobile position with a 90° angle at the elbow, only possible positions that do not induce further pain are lying on my back or inclined slightly on my right side, the reddish-purple discolouration begins on inside of upper arm; (67 hr.) perfusion of saline solution (0.4 liter) with 1 g of hydrocortisone administered intravenously, no noticeable effect on swelling or pain, medications finally purchased, only penicillin from original prescription available in town, three others substituted: (1) injectable procaine penicillin [2 vials], (2) ampicillin capsules, (3) Glifanan tablets for acute, traumatic and chronic pain,

and (4) Vellopan [Indomethacin] capsules, an anti-inflammatory, began taking maximum doses of the three oral medications, an unknown pain-killing injection given by hospital but, like the other medications, without noticeable effect; (72 hr.) necessary to leave hospital in afternoon to catch boat to Kinshasa, nausea and vertigo still present, can walk about 5 m before collapsing from weakness, dizziness and nausea, neck muscles swollen and aching on both sides up to base of skull, quite painful to turn neck in either direction, swelling has spread over all of *pectoralis major* muscle and ¾ of *latissimus dorsi* on left side, elevation of torso causes immediate tachycardia and my arm to sting, burn and ache simultaneously, tingling sensation persists and pain remains at a high level.

Day 5 (22 April): nausea disappears but vertigo and tachycardia persist when upright or walking, swelling exhibits most extreme development with extension to abdominal region, abdominal muscles (or subcutaneous tissue) have consistency of Jello and actually quiver when I move, causing pain in my mid-body region, kidneys become painful and urine turns dark orange, purple and red discolouration spreading over forearm and faint discolouration appears on fingers and palm of hand, blistering begins on two bitten fingers, which are now slightly movable, I begin taking daily injections of penicillin (3 million units) and Novamine (pain-killer) for a period of one week (I was given a supply of penicillin hypodermics to inject once a day).

Day 6 (23 April): woke up at 03:00 hours with intense pain adjacent to the bones of my forearm, palm light purple all over, upper abdomen turning purple, puncture sites appear normal, lacking discolouration, lymph nodes mildly painful still, kidney pain increasing and sitting, turning my body or even moving puts pressure on my kidneys, resulting in terrible pain, the only comfortable position is lying supine, flexibility increasing a bit as I now am able to just touch fingertips to head for first time but cannot yet bend the elbow. For the next week the worst pain is that which cyclically recurs deep in my arm as a narrow rod of pain along the radius and ulna of my forearm. Is this a nerve?

Day 7 (24 April): woke up at 04:00 hours with unbearable pain along the humerus (upper arm) from my shoulder to the elbow, which lasted several hours before subsiding, swelling has not reduced at all, entire arm is discoloured now as outer arm is turning purple and red, swollen area of the hand and arm now very hard and tight feeling, blistering beginning on the back of my hand, the backs of all five fingers have turned purple at their bases, swelling has terminated at level of waist, lower abdomen turns purple, mid-body region still extremely painful to touch, very limited movement of fingers and joints now possible and I can press all fingers together now, arm begins hurting along the bones (radius/ulna) from elbow to wrist at 19:00 hours, forearm and wrist again appear to swell to the bursting point of my skin, any type of stress or strain causes my arm to sting and burn, feeling like a severe sunburn, still no discolouration around the puncture sites, vertigo finally disappears. Boat stopped at Mbandaka and I was able to buy some Cal-C-Vita (2350 mg vitamin C, 300 IU vitamin D, 15 mg vitamin B_6, and 250 mg calcium) tablets and I began taking three/day.

Day 8 (25 April): woke up at 05:00 hours with recurring pain along my arm bones, pain absolutely excruciating in both upper and lower arms, the inner half of arm very tight like a metal cable but outer portion merely swollen, abdominal viscosity disappears today (thankfully!) and finally it doesn't hurt to walk now, swelling of arm finally starting to subside, an effect of the vitamin C therapy (which was the only medication that elicited results), still necessary to lie down flat or my arm aches badly, direct sunlight hurts my arm (as if sunburned), pain pills continue to be ineffective but I am able to sleep more than before, hand still swollen and hard, not puffy and soft, with back of hand continuing to blister, fingers start itching, flexibility increasing as I can now touch the back of my head with fingertips and thumb can touch forefinger, blood pressure 120/60.

Day 9 (26 April): woke up at 03:30 hours with same intense arm pain along with a fever and diarrhea, which was followed by alternating hot and cold spells (a unique development), vertigo returns again, itching spreads to back of hand, swelling rapidly subsiding since yesterday but inner arm still resembles a tight steel band, arm pain intense, still hot and stinging with persistent prickly pins and needle sensation, hurting mainly with applied pressure, able to lean on elbow for first time

Photograph of a living *Atheris nitschei.*

Photo: Reptiles4all, The Netherlands

without distress, swelling has reduced a little on palm and back of hand but cannot close fingers yet to make a fist, inner side of left knee haemorrhages and small purple spots appear, calf muscle (*gastrocnemius*) sore and area behind knee very tender, neck muscles on both sides continue to ache with movement. At 18:00 hours urine changes from dark orange to pinkish-orange, kidneys still painful, skin on back of hand no longer itching but feels very tight now, similar to the first day when it swelled up, purple discolouration of torso commences from left pectoral and lateral edge of *rectus abdominis* across the rib cage and obliques to the rear of the body adjacent to *erector spinae* muscles, *rectus abdominis* muscles never swelled up, only the external and internal obliques experienced the subcutaneous edema.

Day 10 (27 April): general swelling continues to reduce but pain persists along bones of inner arm, lymph nodes still swollen and uncomfortable.

Day 11 (28 April): discolouration on arm starting to fade away, began wearing arm in a sling today, which helps relieve pain when upright, pain continues internally, in the kidneys, and along the inner arm's tight band, no discolouration of fang sites, back of hand with single purple spot, waist still pink, last penicillin injection administered.

Day 12 (29 April): woke up again at 03:00 hours with excruciating pain in elbow joint and along outer forearm, at 11:00 hours the typically recurring inner arm pain commences from my shoulder to wrist, new symptoms develop at 18:00 hours with swelling starting again on inner wrist and accompanied by distinct numbness along outer side of forearm, kidney pain improved but still sensitive, all discolouration of palm and back of hand has disappeared except for a centrally placed purple "V", with apex proximally, and a purple spot on the ring finger, no swelling or discolouration has affected the puncture sites, still cannot close hand entirely or extend elbow although I can flex my elbow completely closed, arm nearly all purple but discolouration on chest greatly reduced and only faintly visible.

Day 13 (30 April): hand and forearm remain swollen, soft and puffy, painful to touch, numbness spreading over entire hand, forearm and shoulder but upper arm not affected, swelling still diminishing, however an unbearable itching sensation is beginning all over, which, against my better judgment, is causing me to constantly scratch it.

Day 14 (1 May): marked reduction in swelling and discolouration of inner side of upper arm (where first discolouration appeared) and forearm, pain still constant and intense but I am able to move hand and arm more without additional suffering, outer two fingers reduced to normal size, middle finger still immensely swollen and immobile, envenomation sites nearly unaffected with peeling of skin around puncture site on index finger and a tiny depression present at site where majority of venom was injected, haemorrhage of chest, lateral rib area, under left arm and outer waist region nearly vanished, able to bend arm ¾ of the way open at 18:00 hours, entire forearm and hand numb with a rubbery feeling, insatiable itching of skin on both upper and lower arm.

Day 15 (2 May): arm muscles still aching and numb, with intense pain continuing along bones, inner surface of arm still consists of a rock hard band or strap, upper arm still discoloured, impossible to straighten arm completely, all fingers except middle one back to normal size but they are painful when flexed, kidneys only slightly painful, still have difficulty sleeping restfully.

Day 16 (3 May): swelling of arm still decreasing, left arm approaching its normal size, pain persists, making it hard to sleep comfortably, hand still numb but fingers okay, purple colouration remains only on upper arm (both triceps and biceps) and inner surface of forearm, middle finger still greatly swollen,

still cannot close fist or straighten elbow, lymph nodes still sore and swollen.
Day 17 (4 May): trouble sleeping continues as pain keeps waking me up, greatest pain along strap-like band along biceps and forearm, back of hand still swollen, discolouration forms purple bands along entire outer arm plus inner forearm, where pain continues, forearm and hand remain numb, kidney pain terminates.
Day 18 (5 May): pain in arm continues as before, cannot straighten arm yet, forearm discolouration nearly gone, tendons on back of hand now visible as swelling continues to diminish, only middle finger remains enlarged, tight band still present on inner surface and a large transverse cord raised across mid-biceps region.
Day 19 (6 May): pain continues and swelling still reducing, hand and forearm remain numb but skin extremely itchy, hot stinging pins and needles sensation disappears when straining muscles.
Day 20 (7 May): still cannot completely straighten arm, arm hot and numbness continues, lasts still sore, even after the oblique pain disappeared, and still very painful to turn or twist body, can bend fingertips to within 3 cm of palm, veins in bend of elbow visible today, tendons of hand clearly visible.
Day 21 (8 May): pain continues with arm itching badly, upper arm pain gone, only forearm and inner elbow remaining painful, a small purple patch remains on upper and lower arm, knuckles now visible, able to make a fist today (touching fingers to palm) and can nearly straighten arm.
Day 22 (9 May): shoulder, forearm and hand still numb and tingling, forearm discolouration has disappeared, can almost straighten elbow to 180°, tight band persists on inner arm, elbow and biceps, arm hot again.
Day 23 (10 May): middle finger still swollen, skin peeling on palm, dark brown transverse scar remains across lower biceps, covering half of upper arm diameter, upper arm discolouration gone.
Day 24 (11 May): very little pain left, arm nearly straight now, only shoulder and forearm remain numb, arm band still tight, palm of hand tender and slightly swollen, able to close hand comfortably now but hand is weak for holding things, middle finger remains large, arm still hot.
Day 25 (12 May): kidneys and obliques still slightly tender, arm hurting again, skin of palm still peeling, creases in elbow fold are dark brown and scar-like as is biceps scar.
Day 26 (13 May): able to completely straighten arm now but it is still a little swollen and painful, grip much stronger today, kidney and oblique pain gone, tight band remains along inner arm, upper arm now itchy and arm very hot to touch.
Day 27 (14 May): dark transverse marks remain on biceps where skin creases were, larger veins starting to be visible, middle finger still swollen, arm pain only felt when extending arm 180°, deltoid still sore but not numb anymore, forearm still numb, sensation returning to back of hand which is still slightly swollen.
Day 28 (15 May): inner forearm itching badly, tight band remains, deltoid and forearm still numb, middle finger still swollen.
Day 29 (16 May): middle finger and knuckle still swollen, numbness in shoulder nearly gone but still persists in forearm, palm tender.
Day 30 (17 May): pain only occurs when stretching or flexing arm or with direct pressure, finger still swollen, deltoid, arm and back of hand still slightly numb, dark lines remain across inner elbow and biceps, smaller veins in elbow now visible.
Day 31 (18 May): numbness, pain, and swelling remain the same.
Day 32 (19 May): no change in condition, palm skin still peeling.
Day 33 (20 May): no change in condition.
Day 34 (21 May): forearm itchy today, numbness still present with a little pain.
Day 35 (22 May): dark discolouration remains on creases in arm.
Day 36 (23 May): no change in condition: itchy, swollen, numb, and a little pain.
Day 37 (24 May): arm still hot, it hurts to completely stretch it out straight.
Day 38 (25 May): forearm continues to itch and feel numb.
Day 39 (26 May): hand painful to squeeze or stretch, arm itchy, swelling of middle finger now reduced by 50%,dark transverse scar remains, arm still hot and a little stiff.
Day 40 (27 May): middle finger smaller but still swollen, all tendons on back of hand visible with extension of fingers.
Day 41 (28 May): dark transverse scars (two creases in elbow and one across biceps 5 cm from joint) remain, deltoid and forearm still a

little numb, hand painful to extend fingers or close fist.
Day 42 (29 May): colouration of entire arm darker than right, appearing like a suntan, especially around inner elbow and inner arm areas, biceps veins visible today, bones of forearm painful to press.
Day 43 (30 May): middle finger still swollen, arm dark, can straighten arm now without pain but painful to stretch fingers.
Day 44 (31 May): forearm and hand still sensitive to strong pressure, dark lines remain, painful to flex hand backwards.
Day 60 (16 June): entire arm a shade darker than right, middle finger still slightly swollen, dark creases remain on arm.
Day 130 (25 Aug.): middle finger 8 cm circumference, right finger 7 cm (12% swollen).
Day 200 (3 Nov.): left arm still slightly darker than right one but dark creases have disappeared, the middle finger still slightly enlarged.
Day 365 (17 April): tiny scar remains from index finger puncture but no trace of mark on middle finger, which is still slightly swollen (7.5 cm vs. 7 cm), left arm only slightly darker than right arm.

DISCUSSION

I have been able to track down references to a half-dozen other *Atheris nitschei* bites, none of which were fatal. Case #1 involved Micah Stancil, who was bitten by both fangs on the left hand and experienced tremendous pain and swelling past the elbow. He lost consciousness for four hours at the hospital; upon waking the swelling was up to his shoulder. The venom inhibited his blood to clot so he had to stay in the hospital for two weeks, by which time the swelling had mostly disappeared. His hand remained stiff and blistered but eventually the only lasting effect was a stiff joint on the bitten thumb (Stancil, 2000).
Case #2 concerns a private herpetoculturist that was bitten in 1996 and experienced a serious medical emergency (SWAZI, 2007).
Case #3 involved Justin Moss, a pet shop owner in Pretoria, who was bitten on his right index finger on 26 September 2007 and experienced excruciating pain as if boiling hot water or acid was being injected, followed by swelling of his arm. He was taken to a hospital within an hour and treated there (without antivenin) but during the first 24 hours he had a dozen blackouts with pain bringing him back to consciousness each time. After 12 hours Moss experienced swelling of his wrist and a burning sensation with excruciating pain in his forearm as it began to swell; he was discharged after two days, at which time his forearm, upper arm and shoulder were three times the natural size; after 2.5 days he became nauseous and vomited, blue/purple discolouration began on his inner arm, and he experienced unbearable pain at any pressure on the arm; during day 4 the swelling had spread down to his waist but was decreasing on his arm and he could not stand or walk for long, the pain still extreme; on day 5 he experienced cold sweats, nausea, and vomiting with the pain moving down his hip and into his kidneys; by day 6 his kidneys were very painful, and swelling reached the lymph nodes in his groin; day 7 saw improvement in both swelling and pain but unbearable itching began on finger; by day 8 the worst of the symptoms had disappeared (MOSS, 2007).

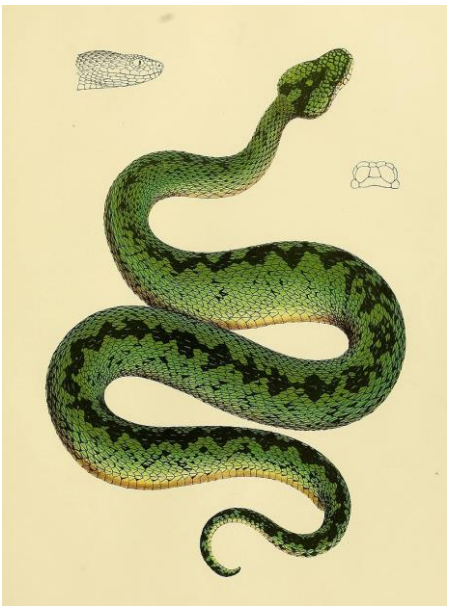

Illustration of *Atheris nitschei* (BOULENGER, 1906).

Case #4 involved a 30 year old male bitten on his left hand. His left upper arm was edematous (swollen) with ecchymoses (discolouration of skin from haemorrhage) in the armpit and he was bleeding from his oral mucosa. Laboratory studies revealed significant hematologic aberrations of haemorrhage and anticoagulant ability, including anemia, thrombocytopenia, coagulopathy, and hypofibrinogenemia (HATTEN et al., 2013).
Case #5 involved Eberhard Fischer in Rwanda but specific details about the bite are lacking (H. HINKEL, pers. comm., *in* SPAWLS et al., 2018).
Case #6 involved another person in Rwanda but details are unknown (H. Hinkel, pers. comm., *in* SPAWLS et al., 2018).

Various studies have shown that the venom of *A. nitschei* has some unique components, which consist primarily of phospholipases (edema inducers), disintegrins (platelet inhibitors), serine proteases (enzymes that break down proteins), and metalloproteases (enzymes that work with calcium or zinc atoms to break down collagen tissue) (WANG et al., 2013, 2018). It possesses a novel phospholipase A_2 protein (WANG et al., 2016), it has a novel disintegrin precursor (WANG et al., 2013), and it contains a new class of histidine and glycine residue peptides (FAVREAU et al., 2007).

In brief, even though *Atheris* species are generally small in size and do not appear dangerous, their bites have mild to serious effects that always include unbearable pain (as from fire-like or radiation-like burning, severe sunburn, boiling water or acid), swelling of the bitten limb or more extensive region (to several times normal size), and a purple/blue/black discolouration of the skin but also incorporates some nausea, dizziness, fatigue, insomnia, blackouts, internal bleeding, and itchiness.

Anyone hunting, collecting, or keeping *Atheris* species should take precaution when catching, handling or moving them as no antivenom was nor is available.

SUMMARY

I experienced six previous bites by venomous snakes in Zaire from 1979–1980 (three by *Causus maculatus* and one each by *Atractaspis irregularis*, *Naja christyi* and *Naja melanoleuca*), two of which were dry, resulting in effects lasting from two hours to two weeks (WALLACH, 1980a-b). In contrast, the bite by *Atheris nitschei* in 1981 produced severe consequences lasting up to a year afterwards.

SAMENVATTING

Gedurende mijn verblijf in Zaïre van 1979-1980 werd ik zesmaal eerder gebeten door gifslangen (driemaal door *Causus maculatus* en eenmaal elk door *Atractaspis irregularis* en *Naja christyi* en *Naja melanoleuca*), waarvan er twee geen gif inbrachten en had ik daarvan slechts twee uur tot hooguit twee weken last (WALLACH, 1980a-b). Daarentegen veroorzaakte de beet van *Atheris nitschei* in 1981 ernstige gevolgen die tot een jaar later nog merkbaar waren.

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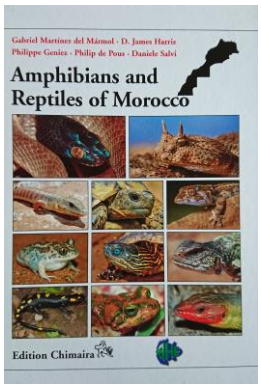
Book review



MARTÍNEZ DEL MÁRMOL, G., J.D. HARRIS, P. GENIEZ, P. DE POUS & D. SALVI, 2019. Amphibians and reptiles of Morocco. Frankfurt Contributions to Natural History Volume 74, Edition Chimaira, Frankfurt am Main.
478 pages, bound, colour photos.
ISBN 978-3-89973-117-0
€ 128.-

It has taken more than twenty years for a book to be written that completely covers the herpetofauna of Morocco, but we can now obtain one as a 2.5 kg(!) volume in A4 format in English. The collective of authors from Spain, Portugal, Italy, France and The Netherlands have different backgrounds but a similar passion for Moroccan herps and that is what makes the combination work.

In 1996 BONS & GENIEZ (1996) and SCHLEICH et al. (1996) put Morocco herpetologically on the map, while BONS & GENIEZ (1996) presented an atlas in three languages that inspired others to collect new information in this part of the world. Since that time a lot of research, especially genetic, has been conducted. Another example is GENIEZ et al.'s (2004) publication of an atlas and field guide to the Western Sahara. However, a complete Moroccan overview was still lacking. In cooperation with www.moroccoherps.com the authors of the book under review collected recent data and any changes concerning the Moroccan herpetofauna. The idea to publish a field guide was apparently initially conceived independently by the five authors, but as quite often happens, it took time before the idea was fully developed. And then it helps when a publisher, in this case Chimaira, pushes the plan into a proper publication. In this case, the end result is not a field guide but rather a hybrid between a field guide and a photo book.

The first forty pages of this book contain generalities, including a preface, biogeography, climate, threats, and conservation. This section also includes a justification of the choices made in taxonomy and species selection, e.g. the sea turtles are omitted and the politically contested Western Sahara is included. Interestingly and to me positively, threats are discussed at the outset of this book rather than at the end, which is more commonly seen. Many different dangers are listed but, in my own experience, poverty combined with the flocks of sheep and goats that eat almost anything, are the main hazards.

In this massive tome, 117 species are described and pictured. While leafing through the book, my first impression was one of a photographic ode to the herpetological richness of the area, which is aided by the book's large format. Some of the photos are presented on a full two-page spread and only a few pictures are disappointing. Throughout the images, the choice was made to present details of larvae, or other typical morphological characters (like the black spatula in *Pelobates varaldii* or the scalation or limb structure in lizard species). Each species includes a head portrait with an explanation in the text or in the photo. The English, French, and Spanish names [but why not the Arabic names?] are included, similar to BONS & GENIEZ (1996), although their book was fully trilingual. Distributions are indicated on dot maps, instead of shading a general area as is so often uselessly done.

In the next portion of the book we find species characters, habitat, biology, and additional remarks. The Red List status of each animal is provided. The texts are short and limited to the essential, which I found disappointing. I had secretly hoped to see a review and survey of all pertinent literature, but alas, my

Scelarcis perspicillata.

Photo: Sergé Bogaerts

hopes were dashed as this is not included. Most taxonomic papers can be found, but few ecological ones. Because of this, the book does not have the same scientific impact as SCHLEICH et al. (1996) and BONS & GENIEZ (1996). On the other hand, this book will probably appeal to a much wider target group, thereby attracting a wider audience.

The lay-out is clear, but I felt that the proper choices were not always made. For example, the colours in some of the photos are somewhat over-saturated. Sometimes the species are pictured on the left page, while the description only starts on the right page. The distribution map does not have a consistent place throughout the book – sometimes it can be found under the name, at the end of the page or even on the following leaf.

The price of the hefty tome is considerable, which might deter a number of enthusiasts from purchasing it. But regardless of the cost, and as the authors state in the book, I too hope that young and old and professional and hobby herpetologists, will be attracted to Morocco, a country with so much left to discover.

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Sergé Bogaerts
Lupinelaan 25
NL-5582 CS Aalst-Waalre
The Netherlands
s-bogaerts@hetnet.nl