

## SNAKE SPECIES AND THEIR PARASITIC INFECTIONS IN BENIN CITY, NIGERIA

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### ABSTRACT

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A survey of snakes and their parasites was conducted in Benin City (University of Benin, Ekiadolor, Ekosodin, Oluku, and Evbabogu) in the rainforest of southern Nigeria. Nine species of snakes belonging to three families Colubridae, Pythonidae and Viperidae and consisting of three venomous and six non-venomous species were encountered. Family Viperidae comprised three species (*Causus maculatus*, *Boiga blandingii* and *Bitis gabonica*) while family Colubridae species were *Mehelya poensis*, *Psammophis phillipsi*, *Philothamnus* spp, *Lamprophis fuliginosus* and *Gastropyxis smaragdina*. The Family Pythonidae had only one representative, *Python regius*. The most prevalent (23.8%) snake was *Lamprophis fuliginosus*. Eighteen (85.7%) of the snakes examined were infected with endoparasites, including *Kalicephalus* spp. and *Ophidascaris* spp. (Nematoda) and *Ophidotaenia* spp. (Cestoda) *Kalicephalus* spp. had a prevalence of 83.3% while *Ophidascaris* and *Ophidotaenia*, had 16.7% each.

**Keywords:** Snakes, endoparasites, *Kalicephalus*, *Ophidascaris*, *Ophidotaenia*

### INTRODUCTION

Snakes are a group of reptiles that are most hated by people and hardly survive encounters with humans. They are always neglected by many researchers although they play significant roles in the ecosystem (Eniang and Ijeomah, 2011). Snakes are sensitive to habitat alterations. Since they occupy high levels in the food chain, they are sensitive to a broad range of environmental stressors that disrupt lower trophic levels (Raxworthy and Attuquayefio, 2000). Snakes are therefore excellent target organisms for long-term monitoring of habitat quality and should be regularly and largely used by environmental impact assessment (EIA) projects (Politano, 1998). The knowledge of Nigerian reptiles in general and snakes in particular is still low despite the already existing contributions and records. Studies on snake fauna documented so far are mostly from southern eastern Nigeria which extends from the Niger Delta (Port Harcourt, River State) to the Cross River bordering the Cameroon (Calabar, Cross River State). Available literature has shown that most studies were carried out in various habitats and varied snake diversity recorded (Akani *et al.*, 1999ab; Luiselli and Akani, 1999, 2002; Eniang and Luiselli, 2002; Eniang *et al.*, 2002ab; Eniang and Ijeomah, 2011; Akinsola and Adebawale, 2007).

Snake fauna recorded in South Eastern Nigeria were forest species including *Toxicodryas blandingii*, *Theleotornis kirtlandii*, *Thrasops flavigularis* and *Rhamnophis aethiops* (Luiselli and Akani, 2002); In altered habitats (savanna and plantains) species found include *Psammophis phillipsi*, *Philothamnus nitidus* and *Naja nigricollis* (Luiselli and Akani, 2002). Snake species reported in areas experiencing deforestation are *Python regius*, *Lamprophis olivaceus*, *Gastropyxis smaragdina* (Akani *et al.*, 1999b; Eniana *et al.*, 2002b) while aquatic species include *Afronatrix anoscopus* and *Grayia smythii* (Akani *et al.*, 1999b). In protected habitats such as the Cross River National Park major snake species encountered were *Atheris squamiger*, *Causus maculatus*, *Psammophis phillipsi* and *Naja nigricollis* (Eniang and Ijeomah, 2011). In the Osun groove on south-western Nigeria (forest reserve), snake species common to this area were mainly *Afronatrix anoscopus* and *Calabaria reinhardii* and less common ones like *Philothamnus semivariegatus*, *Boiga blandingii* and *Dendroaspis viridis* (ref). In a study carried out by Adeiza and Minka (2013) in the Guinea Savannah zone of Nigeria, nine snake species were identified. Fifty-eight percent of the snakes were *Naja* spp and the most common species was *Naja nigricollis* (black necked spitting cobra). Other snake species encountered were *Pseudonaja goldii*, *Bitis arietans*, *Deudroaspis jamesoni*, *Dipholidus typhus* and *Causus rhomboidalis*.

Unlike snake fauna studies, the study of snakes' parasites in Nigeria is very much in its infancy. The most detailed study thus far conducted is that by Adeiza and Minka (2013), which was conducted in the Guinea Savannah zone of Nigeria. The parasites recorded in that study were majorly Coccidia (42%) and Strongyloides (22%). Other parasites recorded were hookworm (8%), *Trichuris* (6%), *Ascaris* (10%), and ectoparasites (29%). Bacteria isolates were also found in 92% of the snakes. Presently, information on the parasites of snakes in the southern part of Nigeria is lacking. This paper though a preliminary report is the first on the abundance and species richness of snake species in Benin City and environs, as well as parasitic infections of these reptiles.

### MATERIALS AND METHODS

The study was conducted in Benin City (University of Benin, Ekiadolor, Ekosodin, Oluku, and Evbabogu), which is located in the rainforest of Southern Nigeria (6° 20' N and 5° 38' E) and has an annual rainfall of 1850 mm –

2455mm and mean temperature of approximately 30 °C. Post mortem examinations were conducted on the snakes shortly after they were killed. Snakes not immediately examined were preserved by freezing in a refrigerator until examined. Various parts of the snakes including oesophagus, stomach, small intestine, large intestine, lungs and liver were opened up in normal saline (0.72% NaCl) and examined under a dissecting microscope for parasites. The body cavity was examined visually. Nematodes isolated were fixed in hot 70% alcohol and preserved in 70% alcohol. The cestodes were flattened under a cover slip pressure on a microscope slide and fixed in 10% formalin. For detailed study and identification of nematode, parasites were cleared in lactophenol, cestodes were removed from 10% formalin washed in several changes of tap water to remove the preservative and then stained with a dilute solution of acetocarmine overnight. Permanent mounts of stained cestodes were made in Canada balsam after dehydrating the worms in ascending concentrations of ethanol (50: 70: 90: 100%) and clearing with xylene. Nematodes were identified using guides provided by Yamaguti (1961), while cestodes were identified using keys by Khalil *et al.* (1994).

## RESULTS

A total of 21 snake specimens belonging to nine (9) species from three families (Viperidae, Pythonidae and Colubridae), consisting of three (3) venomous species and six (6) non-venomous species were examined during the study (Table 1). Of the nine (9) species examined three (3) species (*Causus maculatus*, *Boiga blandingii* and *Bitis gabonica*) belonged to family Viperidae, five (5) species (*Mehelya poensis*, *Psammophis phillipsi*, *Philothamnus sp.*, *Lamprophis fuliginosus* and *Gastropyxis smaragdina*) to the family Colubridae and one (1) species (*Python regius*) to the family Pythonidae. The venomous snakes included *Causus maculatus*, *Boiga blandingii* and *Bitis gabonica* while the non-venomous species were *Mehelya poensis*, *Psammophis phillipsi*, *Philothamnus sp.*, *Python regius*, *Lamprophis fuliginosus* and *Gastropyxis smaragdina*. The most prevalent snake (23.81%) was *Lamprophis fuliginosus* (Table 1). Eighteen (85.7%) of the examined snakes were infected with parasites (Table 2). All five *Lamprophis fuliginosus* and other snake species examined were infected with the exception of *Boiga blindingii* where only one of the two specimens examined was infected. Two of the three unidentified snakes were also infected, only *Gastropyxis smaragdina* was uninfected.

Two parasite taxa namely Nematoda and Cestoda were recovered (Table 3). The nematodes recorded were identified as *Kalicephalus sp.* (family Diaphanocephalidae) and *Ophidascaris sp.* (family Ascarididae). The only cestode found was an *Ophidotaenia sp.* The nematodes were more prevalent with *Kalicephalus* infecting 15 snakes (8 species) comprising *Causus maculatus*, *Boiga blandingii*, *Bitis gabonica*, *Python regius*, *Philothamnus sp.*, *Lamprophis fuliginosus*, *Mehelya poensis* and *Psammophis phillipsi*. *Ophidascaris* infected 5 snakes (3 species) comprising *Causus maculatus*, *Python regius* and *Lamprophis fuliginosus*. *Ophidotaenia* infection was recorded in only one snake (*Causus maculatus*) (Table 3). There were instances of multiple infections. They occurred in: one *Causus maculatus* harboured *Kalicephalus*, *Ophidascaris* and *Ophidotaenia*; *Python regius* and *Lamprophis fuliginosus* harboured both *Kalicephalus* and *Ophidascaris*. The parasites were recovered mostly from gastrointestinal tract, however a few *Kalicephalus spp.* and *Ophidascaris spp.* were found in the body cavity.

Table 1: Snake species from Benin City

Snake species	Family	No examined	Relative abundance (%)
Venomous			
<i>Causus maculatus</i>	Viperidae	2	9.5
<i>Boiga blandingii</i>	Viperidae	2	9.5
<i>Bitis gabonica</i>	Viperidae	2	9.5
Non – venomous			
<i>Python regius</i>	Pythonidae	2	9.5
<i>Philothamnus sp.</i>	Colubridae	2	9.5
<i>Lamprophis fuliginosus</i>	Colubridae	5	23.8
<i>Mehelya poensis</i>	Colubridae	1	4.8
<i>Psammophis phillipsi</i>	Colubridae	1	4.8
<i>Gastropyxis smaragdina</i>	Colubridae	1	4.8
Unidentified species	Unknown	3	14.3

## DISCUSSION

The snakes species recorded in this study are known fauna of the forested areas of southern Nigeria (Butler and Reid, 1986, 1990; Akani *et al.*, 1999; Luiselli and Akani, 1999, 2002; Eniang *et al.*, 2002; Akinsola and Adebowale, 2007; Eniang and Ijeomah, 2011). The finding in this study that the family Colubridae was the predominant in terms of abundance and species richness also agrees with the report of previous investigators (Akinsola and Adebowale, 2007; Eniang and Ijeomah, 2011). *Causus maculatus* (Carpet yiper) and *Psammophis phillipsi* recorded in this study and previously in eastern Nigeria are savanna species common to the middle belt

region and other northern locations of Nigeria. They seem to have adapted to life in the rainforests due to heavy deforestation that has gradually converted rainforests to derived savannah. The thick vegetation cover of the rainforest shields them from predation by aerial predators such as eagles, hawks and falcons and the absence of seasonal flooding in rainforest, an occurrence in the savannah therefore that flushes them out of their burrows and hiding places. Apart from the aforementioned studies in the forested areas of Nigeria, Adeiza and Minka (2013) have documented the snake species of the Guinea Savannah of Nigeria, majority of which are venomous snakes. A greater proportion (58%) of the snakes recorded in the savannah was *Naja* spp. with *Naja nigricollis*, the black necked spitting cobra being the most common (Adeiza and Minka, 2013). Hughes (1983) reported that northern Guinea savannah is home to *Naja* spp, especially *Naja nigricollis*. Other snakes species reported by Adeiza and Minka (2013) included *Bitis arietans* (puff adder), *Causus rhombeatus* and *Dispholidus typus*, which were most abundant in the southern Guinea Savannah. These species have also been reported to flourish in forest areas, but also migrate to the southern savannah zone, but are rarely found in northern Guinea Savannah.

Table 2: Prevalence of parasites in snakes from Benin City

Snake species	Family	No. examined	No infected (%)
<i>Causus maculatus</i>	Viperidae	2	2(100)
<i>Boiga blandingii</i>	Viperidae	2	1(50)
<i>Bitis gabonica</i>	Viperidae	2	2(100)
<i>Python regius</i>	Pythonidae	2	2(100)
<i>Philothamnus</i> spp.	Colubridae	2	2(100)
<i>Lamprophis fuliginosus</i>	Colubridae	5	5(100)
<i>Mehelya poensis</i>	Colubridae	1	1(100)
<i>Psammophis phillipsi</i>	Colubridae	1	1(100)
<i>Gastropyxis smaragdina</i>	Colubridae	1	0(0)
Unidentified species	Unknown	3	2(66.67)
Total	3	21	18(85.71)

Table 3: Prevalence and intensity of parasites in snakes examined from Benin City

Parasites	No. of host examined	No. of host infected	Prevalence (%)	Total no. of parasites isolated	Mean intensity of infection $\pm$ SD
Venomous snakes					
Nematoda					
<i>Kalicephalus</i> sp	6	5	83.33	159	31.3 $\pm$ 39.39
<i>Ophidascaris</i> sp	6	1	16.67	18	18.0 $\pm$ 7.34
Cestoda					
<i>Ophidotaenia</i> sp	6	1	16.67	10	10.0 $\pm$ 4.08
Non-venomous snakes					
Nematoda					
<i>Kalicephalus</i> sp	12	9	75.00	159	31.3 $\pm$ 39.39
<i>Ophidascaris</i> sp	12	4	33.33	18	48.3 $\pm$ 38.76

Not much attention has been given to the study of snake parasites in Nigeria. The most detailed report until now was that of Adeiza and Minka (2013). In that study, Adeiza and Minka (2013) reported 29% infection with ectoparasites, with *Aponomma (Amblyomma) latum* being the most prevalent. In contrast, ectoparasites were not recorded in the snakes examined in this study. While 85.71% endoparasite infections were recorded in the snakes from the present study (rainforest), Adeiza and Minka (2013) recorded a much lower (34%) infection rate, with one or more endoparasites. Jon *et al.* (2012) who worked in urban old growth forest recorded 64.7% infection in snakes examined.

Differences seem to exist in the endoparasite fauna of snakes from the savannah (Adeiza and Minka, 2013) and those we examined in the rainforest. Whereas coccidians (42%) and Strongyloides (22%) were the major parasites of the savannah snakes, nematodes (*Kalicephalus* spp. – 83.33%, and *Ophidascaris* spp. – 16.67%) in addition to the cestode, *Ophidotaenia* spp. (16.67%) infected the snakes from Benin City. *Kalicephalus* and *Ophidascaris* are known common parasites of snakes and lizards (Yamaguti, 1961; Martins *et al.*, 2003) and have been described as snake specialists by Edward and Bush (1989). Larvae of *Ophidascaris* spp. have been severally reported in the body cavity of several anuran species (Aisien *et al.*, 2003, 2004, 2009) and the Agama lizards (Odigwe, 1985) in southern Nigeria. Imasuen *et al.* (2012) was of the opinion that these larvae used amphibians as intermediate hosts for the trophic transmission of these parasites to their ophidian hosts. Sprent (1998) experimentally demonstrated that frogs served as intermediate hosts for *Ophidascaris obconica*. Parasitic infections in snakes are significant for two reasons. Firstly the heavy parasitic infections in snakes have been shown to adversely affect their

reproductive ability (Klingenberg, 1993) and thereby their diversity. Secondly, presence of pathogens and parasites in snakes could be a health risk to folks that consume snake as a delicacy meat.

## CONCLUSION

Snake species commonly found in Benin City located in the rainforest of southern Nigeria and examined were majorly non-venomous species known to be domicile in other rainforest locations in southern Nigeria. Unlike the savannah where major snake endoparasites were coccidians, nematodes predominated in the specimens from the rainforest examined in this study. Adults of *Kalicephalus* sp. and *Ophidascaris* are reported for the first time in Nigerian snakes.

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## REFERENCES

- Adeiza, A. A. and Minka, N. S. 2013. Ecological distribution of snakes and the prevalence of parasitic infestations and bacterial isolates from snakes captured within the Guinea Savannah Zone of Nigeria. *Journal of Ecology, Environment and Biology* 2(1):72–77.
- Aisien, M. S. O., Ogoannah, S. O. and Imasuen, A. A. 2009. Helminth parasites of amphibians from a rainforest reserve in south-western Nigeria. *Africa Zoology*, 44(1):1–7.
- Aisien, S. O., Ajakaiye, F. B. and Braimoh, K. 2003. Helminth parasites of anurans from the savannah mosaic zone of south-western Nigeria. *Acta Parasitologica*, 48(1):47–54.
- Aisien, S. O., Ayemi, E. and Ilechie, I. 2004. Helminth fauna of anurans from the Guinea Savanna at New Bussa, Nigeria. *Africa Zoology* 39(1):133–136.
- Akani, G. C., Barieene, I. F., Capizzi, D. and Luiselli, L. 1999a. Snake communities of moist rainforest and derived savannah sites of Nigeria: biodiversity patterns and conservation priorities. *Biodiversity Conservation* 8: 629 – 642.
- Akani, G. C., Eniang, E. A., Ekpo, I. J., Angelioi, F. N. and Luiselli, L. 2003. Food habits of the snake *Psammophis phillipsi* from the continuous Rainforest Region of Southern Nigeria (West Africa). *Journal of Herpetology* 37(1):208–211.
- Akani, G. C., Luiselli, L. and Politano, E. 1999b. Ecological and conservation considerations on the reptile fauna of the Eastern Niger Delta (Nigeria). *Herpetozoa*, 11:141–153.
- Akinsola, I. A. and Adebawale, A. 2007. The snakes of Osun Grove: A world Heritage site in Osogbo, Nigeria. *Review Biological Tropical (International Journal of Tropical. Biology* 55(2):717–721.
- Edward, D. D. and Bush, A. O. 1989. Helminth communities in avocets: Importance of compound community. *Journal of Parasitology* 98: 439 – 445.
- Eniang, E. A. and Ijeomah, H. M. 2011. Diversity of ophidian species in Oban Division of the Cross River National Park, Nigeria. *Production Agriculture Technology*. 7(1):188–201.
- Eniang, E. A. and Luiselli, L. 2002. Ikpan wetland rainforest: An area of high biodiversity importance in South Eastern Nigeria. *Revue D Ecologie-La Terre Et La Vie* 57:19–27.
- Eniang, E. A., Ebin, C. O. and Luiselli, L. 2002a. On the composition of the snake fauna of Okwangwo Division of Cross River National Park, a hilly forest – Savanna transition zone in South Eastern Nigeria. *Herpetozoa* 15(1/2): 79 – 92.
- Eniang, E. A., Ekpo, I. J., Akani, G. C. and Luiselli, L. 2002b. On the composition of the snake fauna of Uyo, a recently deforested area in Nigeria. *Herpetozoa* 14(3/4):143–147.
- Hughes, D. 1983. African snake faunas. *Bonn Zoology Beitr* 34:311–356.
- Imasuen, A. A., Ozemola, H. J. and Aisien, M. S. O. 2012b. Anurans as intermediate and paratenic hosts of helminth infections in the rainforest and derived savannah biotopes of Southern Nigeria. *International Journal of Zoology*, 2012:1-7
- Jon, R. D., Sarah, A. B., Adiha, A. K., Anna, U. G., John, M. G. and Laura, E. L. 2012. Snake parasitism in an urban old-grown forest. *Urban Ecosystem* 15: 739 – 752.
- Klingenberg, R. J. 1993. Understanding reptile parasites: A basic manual for Herpetoculturists and Veterinarians. *The Herpetocultural Library Special Edition*. 81p.
- Luiselli, L. and Akani, G. C. 1999. Habitats of snakes in the rainforest of Eket (Akwa Ibom State, South Eastern Nigeria). *Herpetozoa, Wien* 11(3/4):99–107.
- Luiselli, L. and Akani, G. C. 2002. An investigation into the composition complexity and functioning of snake communities in the mangroves of Southern Nigeria. *African Journal of Ecology* 40:220–227.

- Martins, M. H., Correia dos Santos, L., Vincente, J. J., Muziz-Pereira, L. C. and Magalhaes, R. .2003. *Ophidascaris durissus* sp. nov (Nematoda, Ascarididae) parasitizing *Crotalus durissus* Linnaeus (Ophidia, Viperidae) in Brazil. *Revista Brasileira de Zoologia* 20:9–11.
- Odigwe, F. W. 1985. Survey of helminth parasites infecting lizards in Benin City, Nigeria. B.Sc. Dissertation, University of Benin. 50p
- Politano, E. 1998. A study of the fauna of the Niger Delta and environmental impact assessment of the construction of two natural gas pipelines in the Rivers State. Port Harcourt (T. S. K. J. – Aquater Reports), 561p.
- Raxworthy, C. J. and Attuquayefio, D. K. 2000. *Herpetofaunal communities at Muni Lagoon in Ghana. In: Biodiversity and Conservation*, Oxford. 9:501–510.
- Yamaguti, S. 1961. The nematodes of reptiles: In *Systema Heminthum* Vol. III. Interscience Publishers, Inc. New Yorks, 127–128.