Trematodes of the Genus Mesocoelium, Parasites of Anurans in the Ganzourgou Province, Burkina Faso

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Abstract

The Trematodes of the genus *Mesocoelium* parasites of Anurans from Mogtedo, Zam, and Zorgho, in the area of Ganzourgou in Burkina Faso have been investigated between August, 2018 and January 2019. A total of 233 Anurans belonging to 5 families, 5 genera, and 9 species were examined. The species of Anurans examined were: *Hoplobatrachus occipitalis*, *Amnirana galamensis*, *Ptychadena bibroni*, *Ptychadena pumilio*, *Sclerophrys pentoni*, *Sclerophrys maculata*, *Sclerophrys regularis*, *Sclerophrys xeros*, and *Xenopus fischbergi*. The Anurans were collected by hand using the Visual Acoustic Encounter Survey (VAES) method. Amphibians were euthanized and dissected to examine the digestive tract and their appendices for Trematodes of the genus *Mesocoelium*. A total of 9 species of the genus *Mesocoelium* were recovered, with an overall prevalence of 11.16%. The Trematodes that have been recovered were: *Mesocoelium monas*, *Mesocoelium brieni*, *Mesocoelium sociale*, *Mesocoelium microon*, *Mesocoelium incognitum*, *Mesocoelium danforthi*, *Mesocoelium americanum*, *Mesocoelium monody,* and *Mesocoelium megaloon*. The means intensity of infestation was generally low except for *Mesocoelium incognitum* (100.5 parasites / infested host). That infestation was influenced by the selectivity of the host by the Trematodes. It appears that in the 9 species of Anurans examined, only 3 species were infested by parasitic Trematodes (*Hoplobatrachus occipitalis*, *Sclerophrys*

maculata and *Sclerophrys regularis*). The preferred organ of the genus *Mesocoelium* infestations in the host was the small intestine. Histopathologic studies in infested organs will be carried out to show the impacts of the Trematodes of the genus *Mesocoelium* in their hosts.

Keywords: Trematoda, *Mesocoelium*, Anurans, Ganzourgou, Burkina Faso

Introduction

Amphibians are a significant source of food for both humans and animals. They have always been considered locally as an essential source of protein (Angulo, 2008; Mohneke *et al*., 2009). In Burkina Faso, according to studies by Mohneke *et al.* (2010), almost all the harvested amphibians are consumed in the province of Ganzourgou, where they are highly prized and are used in traditional medicine. Indeed, toads are used in the form of soup to treat respiratory infections, measles or boils (Mohneke *et al.*, 2011). Also, it seems likely that direct contact of the toad skin with scorpion bite areas and infected wounds may be beneficial for the patient thanks to the antibacterial actions of the components of the toad's skin (Simmaco *et al.*, 1998; Zhou *et al*., 2006).

Despite the key role of amphibians in balancing and conserving biodiversity, they also face threats leading to the decline of their populations (Johnson *et al.*, 2007). Amphibian infestations are often closely associated with anthropogenic changes in ecological and evolutionary relationships between hosts and pathogens (Kiesecker, 2002; Patz *et al.*, 2005). Pathogens appear to be a key factor in the mortality and morbidity of amphibians (Millerioux, 2010). Indeed, there are bacterial, fungal, viral, and parasitic infestations that affect the survival of amphibians (Mohneke *et al.*, 2010). Studies have shown that the *Amphibiocystidium* parasite has been identified as responsible for the decline of several amphibian species (Turquin, 2016). In many regions of Africa, much is known about parasitic infestation in amphibians (Durette-Desset *et al.*, 1974 in Togo; Gassmann, 1975 in Cameroon; Bourgat *et al.*, 1976 in Benin; Aisien *et al.*, 2004 in Nigeria; Assemian, 2016 in Côte d'Ivoire). Johnson *et al.* (1999, 2001) provide experimental evidence that a Trematode parasite, *Ribeiroia* sp. is responsible for the serious deformities of the limbs observed in certain populations of amphibians. However, the Amphibian Trematodes in Burkina Faso are not well known a lot; hence, the interest of this study. It aims to do an inventory of the parasitic Trematodes of Anurans as well as to define their degree of infestations in the province of Ganzourgou.

Materials and Methods

- Study sites

This study took place in the province of Ganzourgou located in the eastern part of Burkina Faso between latitudes 12 ° 42 'and 11 ° 52' North and longitudes 0 ° 25 'and 1 ° 08' West. Three sampling stations were surveyed from August 2018 to January 2019. They were the sites of Zam (12 ° 18'N; 0 ° 49'W), Mogtedo (12 ° 17'N; 0 ° 50'W), and Zorgho (12 ° 14'N; 0 ° 37 'W). The choice of these sites was guided by the fact that in these communities, in addition to the consumption of Anurans (frogs and toads), the inhabitants also use them in traditional medicine (Mohneke *et al.*, 2010). Additionally, the site of Mogtedo is a home to the largest market for the sale of fried Anurans in the province of Ganzourgou.

- Sampling of Anurans and collection of parasitic Trematodes

The Anurans collection period was conducted from August 2018 to January 2019. Sampling was done by capture near the ponds between 6 p.m. and 9 p.m. and sometime between 4 a.m. and 6 a.m. Anuran species were collected by hand using the Visual Acoustic Encounter Survey (VAES) method (Crump and Scott, 1994), examining the Anurans refuges by lifting the rocks, looking around the bodies of water with headlamps and locating them by their croaking. Each captured Anuran was put in a cotton bag, and then taken to the laboratory to be identified up to by species level using the identification keys of Rodel (2000), Rodel and Branch (2003), and Rodel *et al.* (2005).

Once in the laboratory, the Anurans were euthanized by immersion in a solution of Benzocaine (14 -20%) or 99.4% chloroform for dissection (Aisien, 2018). An incision along the mid-ventral line (from the mouth to the anus) made it possible to remove the digestive tract and its appendices for examination. The parasites were transferred to Petri dishes containing 0.72% of saline solution, then were fixed with 5% formol saline between slide and coverslip and stored in the same area. The Trematodes were rinsed in several distilled water baths, afterwards stained overnight in a solution of carmine boracic diluted from 1 ml to 20 ml. They were then clarified in xylene and mounted between slide and coverslip in a drop of Canada balsam. After drying in an oven, the assembly was observed under a ZEISS brand light microscope (ICS standard 25) fitted with an optical micrometer. Trematodes were identified using the identification keys of Prudhoe and Bray (1982); Norman *et al.* (2012).

- Prevalence rate and mean intensity of infestation

The prevalence rate (P) and mean intensity (MI) were calculated according to Anderson (1993). Prevalence rate was calculated as a percentage

of the number of a particular host species infested (N) with a specific Trematodes parasite (i) divided by the total number of host examined (Ht).

P (%) = Ni/ Ht * 100

The mean intensity (MI) refers to the number of parasites (p) per host (n) (calculated only for the infested hosts examined).

(MI) = p/ n

Results

- Diversity of Anurans collected and their Trematodes of the genus *Mesocoelium*

The specimens of anurans investigated belong to five families (Bufonidae, Dicroglossidae, Pipidae, Ptychadenidae and Ranidae) divided into 09 species, which were: *Amnirana galamensis* (Duméril and Bibron, 1841), *Ptychadena bibroni* (Hallowell, 1845), *Ptychadena pumilio* (Boulanger, 1920), *Sclerophrys pentoni* Andersson, 1893, *Sclerophrys maculata* Hallowell, 1854, *Sclerophrys regularis* Reuss, 1833, *Sclerophrys xeros* Tandy Tandy, 1976, and *Xenopus fischbergi* Evans, 2015. A total of 233 specimens of Anurans were examined for parasite, and 26 (11.16%) specimens of Trematodes belonging to 03 species were infected with Mesocoelidae. The level of infestation in these Anurans is presented in **Table 1**. The Mesocoelidae parasites encountered were composed by: *Mesocoelium monas* Freitas, 1958, *Mesocoelium brieni* Vercammen-Grandjean, 1960, *Mesocoelium sociale* Lühe, 1901, *Mesocoelium microon* Nicoll, 1914, *Mesocoelium incognitum* Travassos, 1921, *Mesocoelium danforthi* Hoffman 1935, *Mesocoelium americanum* Hardwood 1932. In this study, the host specie *S. maculata* appeared to be preferred by *Mesocoelium* species. On the various organs of the digestive tract and the appendices of the Anurans examined, the small intestine is the preferred organ for infestation of the genus *Mesocoelium*.

Table 1: Overall prevalence (%) of *Mesocoelium* in Anurans from Ganzourgou

Trematodes	Hosts species								
Mesocoelium species	*A. galamensis*	*H. occipitalis*	*P. bibroni*	*P. pumilio*	*S. maculata*	*S. pentoni*	*S. regularis*	*S. xeros*	*X. Fischbergi*
M. americanum	-	-	-	-	2.1	-	-	-	-
M. brieni	-	-	-	-	2.6	-	-	-	-
M. danforthi	-	-	-	-	11.2	-	-	-	-
M. incognitum	-	-	-	-	86.3	-	-	-	-
M. megaloon	-	-	-	-	24.0	-	-	-	-
M. monadi	-	-	-	-	-	-	3.4	-	-
M. monas	-	5.1	-	-	-	-	-	-	-
M. microon	-	-	-	-	3.0	-	-	-	-
M. sociale	-	-	-	-	3.8	-	-	-	-

- Prevalence and mean intensity of Trematodes of the genus *Mesocoelium* of Anurans

Table 2 shows the infested host species and their distribution in the two sites, namely Mogtedo and Zam, as well as the overall prevalence and mean intensity of infestation in infested hosts. The Zorgho's site does not harbor Anurans infested with *Mesocoelium*. The highest prevalence and mean intensity of the Trematode was found in the host *Sclerophrys maculata* in Mogtedo. The Trematode *M. incognitum* was the most abundant and was followed by *M. megaloon*. The site with the most Anurans parasitized by these Trematodes is Mogtedo followed by Zam. All the parasites were found only in the small intestine of their host.

Table 2: Parasitization rate of Anuran hosts from Ganzourgou, Burkina Faso

Trematodes	Host	Prevalence (%)	PMean intensity	Sites
M. americanum	*Sclerophrys maculata*	2.1	1.2	Mogtedo
M. brieni		2.6	2.0	Mogtedo
M. danforthi		11.2	13.0	Mogtedo
M. incognitum		86.3	100.05	Mogtedo
M. microon		3.0	3.5	Mogtedo, Zam
M. sociale		3.8	9.0	Mogtedo
M. megaloon		24.03	25.0	Mogtedo
M. monas	*Hoplobatrachus occipitalis*	5.1	3.0	Mogtedo
M. monodi	*Sclerophrys regularis*	3.4	1.3	Mogtedo

Discussion

The Anurans species found in the three sites of the province of Ganzourgou in eastern Burkina Faso have been reported in previous studies carried out by communities in West Africa (Akani *et al*., 2011; Omereji, 2014). Among these collected species, only the species of the family Pipidae are not consumed in Burkina Faso but consumed in other African countries such as Nigeria (Onadeko *et al.*, 2011). The study of the parasitic Trematodes of these Anurans made it possible to identify nine species of Trematodes of the genus *Mesocoelium* reported for the first time in Burkina Faso. The overall prevalence recorded shows a low parasitic infestation of these Trematodes in the Anurans collected. In fact, out of 233 specimens of Anurans examined, only 26 species were infested with Trematodes of the genus *Mesocoelium*. This low infestation rate of Trematodes of the genus *Mesocoelium* in the sampling, could be explained by the absence of its host-type in the study area. Indeed, previous studies have shown that the highest prevalence of Trematodes of genus *Mesocoelium* had been recorded in areas dominated by the species of *Amnirana galamensis* (Aisien *et al.*, 2017).

Almost all *Mesocoelium* species parasitize the Anurans in this study were found in the small intestine. Similar results have been demonstrated by

Aisien *et al.* (2001; 2009; 2017) on Anurans from Nigeria. This study has also shown that in Burkina Faso, Mesocoelium monas infect *H. occipitalis*, *M. monodi* infect *S. regularis*, *M. brieni*, *M. sociale*, *M. microon*, *M. incognitum*, *M. danforthi*, *M. americanum*, and *M. megaloon* infect *S. maculata*. This study increases the geographic extent of these parasites. Indeed, *Mesocoelium monas* has already been harvested from *S. maculatus*, *S. regularis* in Cameroon (Gassmann, 1975) and *Mesocoelium monodi* collected from *S. regularis*, *S. maculata*, *H. occipitalis*, *Ptychadena mascareniensis*, *P. oxyrhynchus*, and *P. pumilio* in Nigeria (Aisien *et al.*, 2003). The prevalence of *Mesocoelium* parasites varies between 2.1 and 86.3% while the means intensities are between 1. 2 and 100.05 parasites / infested host. This difference could be due to the heterogeneity between these Anurans in terms of their susceptibility to infection, i.e., possibly due to differences related to the immunological state (Anderson and Gordon 1982); and by its exposure to highly aggregated infective stages (Esch *et al.*, 1988). The highest prevalence and mean intensity are recorded in *S. maculata*. This Anuran species is more parasitized by the Trematode *M. incognitum* with a prevalence of 86.3% and a mean intensity of 100.05 parasites / infested host. In the three surveyed sites, only *S. maculata* parasitized by *M. microon* was found respectively in Mogtedo with a prevalence of 0.43% and a mean intensity of 5 and in Zam with a prevalence of 0.43% and a mean intensity of 2. The others *Mesocoelium* (*Mesocoelium monas*, *M. brieni*, *M. sociale*, *M. incognitum*, *M. danforthi*, *M. americanum*, *M. monodi*, and *M. megaloon*) were collected only from Anurans of Mogtedo. This difference in infection between the three sites could be explained by the use of chemical fertilizers and pesticides not agreed by rice farmers who carry out activities around and in water bodies. These chemical elements constitute a stress for aquatic organisms including amphibians. As the Anuran is weakened, it becomes more accessible not only to predators but also it is made easy for colonization by new parasitic species. Rohr *et al.* (2008) have shown that pesticides have an immunodeficient effect on frogs, which can make them more susceptible to infestation by Trematodes.

Conclusion

The inventory of 233 specimens of Anurans distributed among five families has identified nine species of Trematodes of the genus *Mesocoelium*. They are *Mesocoelium monas*, *M. brieni*, *M. sociale*, *M. microon*, *M. incognitum*, M. danforthi, *M. americanum*, *M. monodi*, and *M. megaloon*. It appears that only three species of Anurans *H. occipitalis*, *S. maculata* and *S. regularis* are infested with these Trematodes. The prevalence or overall infestation rate of these Anurans Trematodes is low (11.16%) in the three sites surveyed. The preferred organ for infestations of Trematodes of the genus *Mesocoelium* is the small intestine of Anurans. Also, the parasitic infestation

of Trematodes of the genus *Mesocoelium* (Parasitic Trematodes) in Anurans varies according to the sites. In this study which is carried out on Anurans consumed in Burkina Faso, it appeared that the prevalence of trematodes is low. These results obtained can be used in raising public awareness for healthy and sustainable consumption of Anurans. Histopathologic studies in infested organs will be carried out to show the impacts of the Trematodes of the genus *Mesocoelium* in their hosts.

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