



## Research Article

### HELMINTH INFECTION PATTERN OF *PTYCHADENA MASCARENIENSIS* FROM DALOA CITY (IVORY COAST) WITH RESPECT TO FROG' AGE AND SEX

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#### ABSTRACT

Population of *Ptychadena mascareniensis* from Daloa city wetlands (Ivory Coast) were investigated for understand helminth infection pattern regarding to hosts' age and sex. A total of 115 specimens of this species were examined. From this population, 67 specimens were infected. We encountered 10 acanthocephalan, 157 nematoda and 231 trematoda. These helminth parasites were identified as *Centrorhynchus* sp. (acanthocephala), *Cosmocercoides variabilis* (nematoda) and *Haplometroides eburnense* (trematoda). The overall prevalence rates were high except for infections with acanthocephala. Adult hosts prevalence of nematoda and trematoda infections were higher than juveniles. No acanthocephalan was found from juveniles. The prevalence of each helminth in both sexes were almost the same values. The mean intensity of trematoda infection were higher than acanthocephala and nematoda infections. Thus, the highest values of intensity of acanthocephala and nematoda infections were obtained in females. In addition, the correlations between the age or the sex of frogs and the parasitic load were generally low and not significant ( $r \leq 0.257$ ;  $p \geq 0.337$ ). Only in juveniles, the number of trematodes increases with the size of host ( $r = 0.631$ ;  $p = 0.016$ ). Thus, helminth infection pattern was influenced by host diet behavior.

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#### INTRODUCTION

Amphibians' infections are often closely associated with anthropogenic alterations of the ecological and evolutionary relationships between hosts and pathogens (Kiesecker, 2002; Patz et al., 2005). According to Gray et al. (2007), agricultural crops grown in wetlands result in a high prevalence of parasites and a high rate of infections. In aquatic ecosystems, not only increases the infection of the first intermediate hosts (snails), but also increases the rate of infection of amphibians, thus raising the risk of mortality and malformation in these vertebrates (Johnson et al., 2007). Moreover, parasite-induced malformations in amphibians, which may have increased in prevalence and severity in recent decades, cause elevated mortality and morbidity in affected populations (Johnson et al., 1999; Johnson and Chase 2004; Johnson et al., 2007). Hence, there is a possible link between parasitic infections and amphibian population decline (Sessions and Ruth, 1990; Johnson et al., 1999).

In many parts of Africa, much is known about parasitic infection in amphibians (e.g. Durette-Desset, 1974; Gassmann, 1975; Baker, 1987; Aisien et al., 2004). By contrast, parasitic infections of amphibians in Ivory Coast are poorly studied and old for over 30 years (Euzet and Combes, 1969; Maeder, 1969, Maeder et al., 1970; Maeder, 1973; Murith, 1979; Murith, 1981a, b). Parasitic infections of amphibian populations in Ivorian west regions are unknown. This study aims to determine prevalence rate and mean intensity of infection of *Ptychadena mascareniensis* helminth parasites from Daloa city wetlands with respect to host age and sex. More especially, we would try to understand infection pattern regarding adult and juvenile hosts on one hand, male and female hosts on other hand.

#### MATERIALS AND METHODS

##### Study area

Daloa city is located in the Central-west of Ivory Coast (6°53' N and 6°27' W). Covered by dense evergreen forest, this region is now disturbed due to expensive cacao and coffee plantations. Furthermore, the department is watered by the Sassandra River and its tributary, the Lobo flood all localities.

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The survey was realized in four shallows located at the four cardinal points of Daloa city. In these areas, the climate is equatorial characterized by four seasons: longer major dry season extends from December to March, longer major rainy season from April to July, minor rainy season lasts from October to November and minor dry season from August to September (Tastet and Guiral, 1994; Traoré *et al.*, 2012).

### Data collection

The survey sampling was realized in minor rainy season (from October to November 2015). We sampled the target species *Ptychadena mascareniensis* (Duméril and Bibron, 1841) using visual and acoustic surveys in different habitats applying standard techniques by Heyer *et al.* (1994) and Rödel and Ernst. (2004). Due to its nocturnal activities, this species was captured between 7 hour and 10 hour PM. The target species is listed as Least Concern in view of its very wide distribution, its tolerance of a broad range of habitats and its presumed large population (IUCN, 2015).

Frog specimens captured were sexed; Snout-Vent Length (SVL) was measured (with dial calipers) to determine individual size. In the study site, male SVL was comprised between 35 and 55 mm, female between 37 and 56 mm, and juveniles SVL was between 18 and 36 mm. Males have a vocal sac at super position. This species has a wide distribution, inhabiting a broad range of habitats and are presumed to be often locally very abundant (Rödel, 2000; Assemian *et al.*, 2006; Tohé *et al.*, 2015). Target species is widespread in different savannah types and disturbed forest habitats (Rödel, 2000; Rödel and Branch, 2002; Nago *et al.*, 2006; Hillers *et al.*, 2008).

Representative specimens were collected and dissected thereafter in laboratory. The oesophagus, stomach, small intestine and large intestine/rectum were examined for parasites. The lungs, liver/gall bladder, urinary bladder and the body cavity of the amphibians were also examined for parasites. Parasites specimens were fixed and preserved in 70% ethanol after observation on a microscope slide. Helminths were identified by observation and measurement of morphological characteristics based on descriptions from literature (Maeder, 1973; Gassmann, 1975; Baker, 1981, Durette-Desset, 1983; Aisien *et al.*, 2009 and Imasuen and Aisien, 2012). Parasite vouchers and frogs carcasses were kept at Department of Biology and Animal Physiology at Jean Lorougnon Guédé University (Ivory Coast).

### Data analysis

The prevalence rate (P) and mean intensity of infection (MII) were calculated according to Anderson (1993). Prevalence rate was calculated as a percentage of the number of a particular host species infected with a specific helminth parasite divided by the total number of host examined. The mean intensity of infection refers to the number of parasites per host (calculated only for the infected hosts examined). The parasitic load (abundance of each parasite of each host) was estimated and correlated with SVL of frog to understand infection pattern regarding the age and sex. The Kruskal-Wallis and Mann-Whitney non-parametric tests were used to determine

differences in the parasite load in the target species. All these correlations and tests were performed with Statistica 7.1.

## RESULTS

A total of 115 specimens of *Ptychadena mascareniensis* (52 males, 23 females and 40 juveniles) were examined of which 67 specimens were infected (Table 1). Helminth parasites encountered were composed by acanthocephalan (n=10), nematoda (n=157) and trematoda (n=231). Specimen of each endoparasite found in *Ptychadena mascareniensis* digestive tract and body cavity was shown in Figure 3. Acanthocephalan cysts were recovered from the body cavity; nematoda and trematoda were found in small intestine of *Ptychadena mascareniensis* from Daloa shallows. Except for infections with cysts of acanthocephalans (P: 4.3 % and 6.7 %), the overall prevalence rates were high ( $27.5 \% \leq P \leq 52.0 \%$ ) (Figure 2).

The prevalence rates of nematoda (P=52.0 %) and trematoda infections in adults (P=36.0 %) were higher than juveniles (P=27.5 %). We have not found any acanthocephala from *P. mascareniensis* juvenile specimens. Regarding to the sex, the prevalence of each helminth parasites in both sexes (male and female) were almost the same values. Regarding age of specimens, the mean intensity of trematoda infection were higher in adult (MII=5.7) and in juvenile (MII=7.0) specimens than acanthocephala (adult MII=2.0, juvenile MII=0) and nematoda (adult MII=3.1, juvenile MII=3.4) infections. Concerning infection in relation to host sex, the highest values of intensity of acanthocephala (MII=4.0) and nematoda (MII=4.1) infections were obtained in female. Trematoda intensity of infection were almost the same values in both sexes.

Neither these differences were significant (Mann-Whitney test,  $p \geq 0.38$ ). The relationship between host SVL and the parasitic load (abundance) were evaluated. The correlations between the age of frogs and the parasitic load on the one hand and on the other hand the sex and parasitic load are generally low and not significant ( $0.012 \leq r \leq 0.257$ ;  $p \geq 0.337$ ). Consequently, there were low correlations between frog' age or sex and parasite load. Only the correlation between size of juveniles and trematodes abundance in the digestive tract is significant ( $r=0.631$ ;  $p=0.016$ ). Thus, in juveniles, the number of trematodes increases with the size of the specimens.

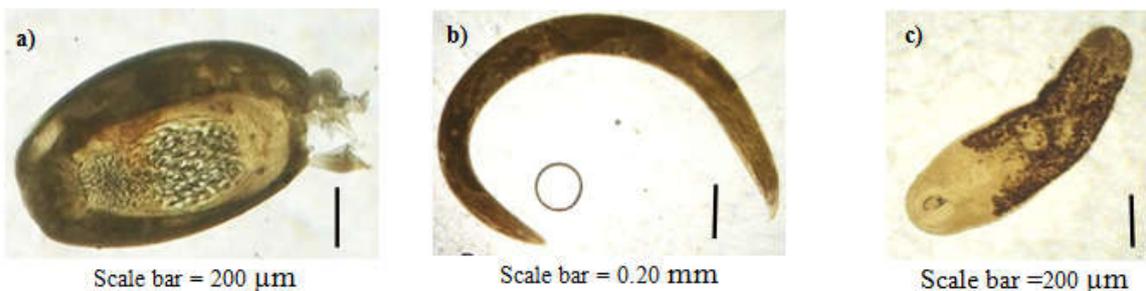
## DISCUSSION

The helminth parasites found in *Ptychadena mascareniensis* in the present study are most similar to those observed amongst the amphibian hosts in other African countries (Aisien *et al.*, 2011; Imasuen and Aisien, 2012; Nguiffö *et al.*, 2015). These helminth parasites were identified: the acanthocephalan cyst was *Centrorhynchus* sp., nematoda was *Cosmocercoides variabilis* and trematoda was *Haplometroides eburnense*. Our results indicate that the prevalence rate of nematode and trematode is higher in adult than juvenile.

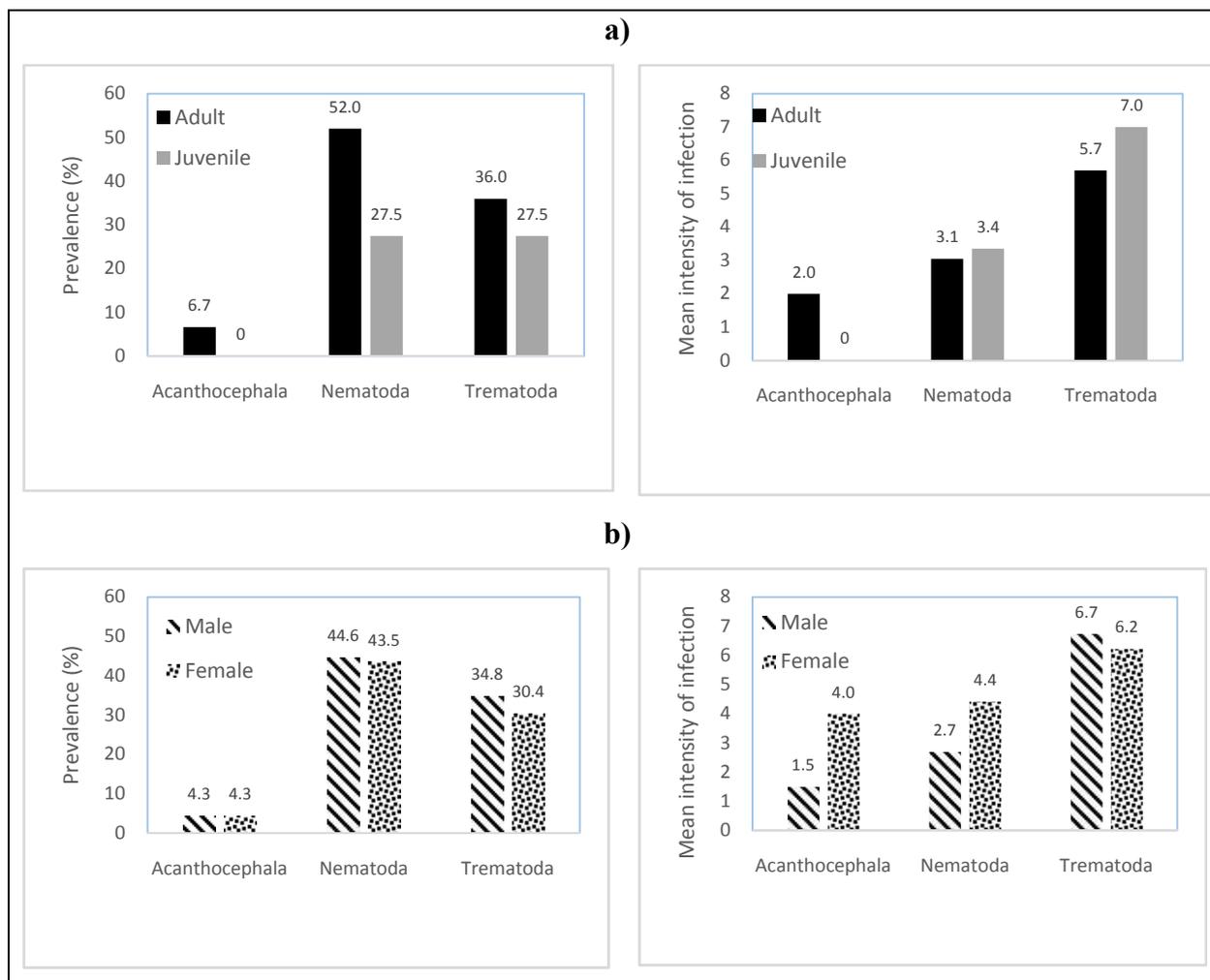
Adults were more infected by the three helminth parasites than juveniles. Furthermore, no acanthocephalan cyst has been found in the body cavity of juvenile hosts. This implies that adult specimens are more exposed to infection by helminths than juveniles.

**Table 1. Parasites abundance from each category individuals of *Ptychadena mascareniensis***

Category	<i>P. mascareniensis</i>		Parasites		
	examined	infected	Acanthocephala	Nematoda	Trematoda
Male	52	37	6	77	100
Female	23	14	4	43	54
Juvenile	40	16	0	37	77



**Fig. 1. Acanthocephalan cyst (a), Nematoda (b), Trematoda (c) specimen recovered from the body cavity and small intestine of *Ptychadena mascareniensis* from Daloa shallows**



**Fig. 2. Pattern of parasite infection of *Ptychadena mascareniensis* from Daloa city shallows with respect to frog' age (a) and sex (b)**

This was probably related to the life cycle of parasites and/or host exposure longtime to infected habitat. Indeed, it has been noticed that generally larger and presumably older host harbor a greater number of parasites than smaller individuals, possibly because of a change in feeding habits (Prudhoe *et al.*, 1982). The mean intensity of trematoda infection were higher than acanthocephala and nematoda infections in juvenile specimens. The metacercariae of various trematoda were sometimes limited to larvae and sometimes to adults (Prudhoe *et al.*, 1982). Concerning the host sex, intensity of acanthocephala and nematoda infections were the highest values in female. These results reveal that the females were more infected by both helminth parasites than males. This suggests that the "different behavior of the sexes of the host affects the course of the life-cycle". Female *Rana pipiens* showed refraction to infestation with trematoda *Haematolechus medioplexus* during the breeding period, whilst male frogs had higher infestation throughout the spawning period (Prudhoe *et al.*, 1982).

In addition, the different pattern of helminth infection with frog age and sex observed here could also be due to the eating behavior of males, females and juveniles. Indeed, Tohé *et al.* (2015) showed that *P. mascareniensis* diet differs between male and female, also between adult and juvenile specimens. Moreover, Barton and Pichelin (1999) assumed that the negative correlation between host SVL and intensity of *Acanthocephalus bufonis* infection is most likely due to a change in diet of the toad *Bufo marinus*.

## Conclusion

Thus, although it is recognized that the environmental conditions and land used influence the relationship between host and parasite, the degree of infection by helminths may depend on the diet behavior of the host. This preliminary study on the helminth parasites of amphibians in Daloa shallows is the first step for future studies to understand their population dynamics and life histories.

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