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Structure and Dynamics of Myxosporean Parasites Component Communities in Two Freshwater Cichlids in the Chari River (Republic of Chad)

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Abstract: Myxosporean parasites of two freshwater Tilapia species from the Chari River, Chad Republic, *Oreochromis niloticus* and *Sarotherodon galilaeus*, were investigated from November 2001 to October 2002. A total of 360 specimens per Cichlid species were examined. Eleven parasite species were found in both cases with different prevalences. *Myxobolus agolus*, *M. brachysporus*, *M. clarii*, *M. cichlidarum*, *M. heterosporus*, *M. tilapiae* and *M. camerounensis* in *O. niloticus*) appeared common while *M. equatorialis*, *M. nyongana* (and *M. camerounensis* in *S. galilaeus*) were secondary; lastly *M. israelensis* (and *M. kainjiae* in *O. niloticus*) were rare. The gills, fins, eyes and teguments were preferential locations of cysts building pathogens while the kidneys then the gall bladder were most commonly infected by myxosporean spores. In the Chari ecosystem, no significant host sex and size effects were found for the parasite cystic load. A clear seasonal occurrence was observed for most of these pathogens. In the view of pathogenic control, this study raised the necessity in a farm fish station to identify the most important myxosporean species and the period of their potential demographic explosion.

Key words: Myxosporea, *Myxobolus*, parasites, *Oreochromis niloticus*, *Sarotherodon galilaeus*, dynamics, Chari, Chad Republic

INTRODUCTION

Myxosporean fauna (Myxozoa: Myxosporea) parasite of freshwater or marine fish is evaluated to more than 1000 species of which about one hundred are known from African fish, 83 of these infect continental water hosts (Fomena and Bouix, 1997). In Africa, studies tackling these pathogens are essentially morphological descriptions. Only few authors viz. Obiekezie and Enyinihi (1988), Obiekezie and Okaeme (1990), Fomena (1995), Gbankoto *et al.* (2001) and Tombi and Bilong Bilong (2004) have considered the dynamic aspect of parasite populations; the latter also studied the parasite populations' structure. Thus, the quantitative data on African Myxosporea seem rare. Siau (1978) argued that the rate of fish infestation depends on its species, size and sampling site; he also stated that the water temperature, the weight and sex of individual host only reinforce the role of the factors mentioned above. Polyparasitism of fish by myxosporeans is a well documented phenomenon. In Cameroon, Fomena and Bouix (1996) found 11 species infecting different organs of *Oreochromis niloticus* Linné, 1758. Recently in Chad, Fomena *et al.* (2004) identified 4 species in *Citharinus citharus* (Citharinidae), but the pathogenic effect is seldom due to a single species (Combes, 1995). This study aimed to study in the wild the structure and the dynamics of myxosporean component communities in two freshwater Cichlids (*Oreochromis niloticus* Linné, 1758 and *Sarotherodon galilaeus* Linné, 1758), to identify in the one hand the most important pathogen(s) species and, in the other hand, the period of parasite explosion, the size (age) and sex of host at risk. These Cichlid species are highly consumed by the human populations in Ndjamena (Chad Republic).

MATERIALS AND METHODS

Samples were collected from November 2001 to October 2002 in the Chari River at Ndjamena (latitude 12° 7 NW and longitude 14° 7 NW). The climate in this town is sahelian tropical (Fig. 1), characterized by a dry season from November to May and a wet season from June to October (Cabot and Bouquet, 1988). Fish were captured with nets, kept in polyethylene containers and rapidly sold in the Farcha market. For each host species, a minimum of 30 individuals per month were bought. They were first washed in tap water, weighed (g) and total

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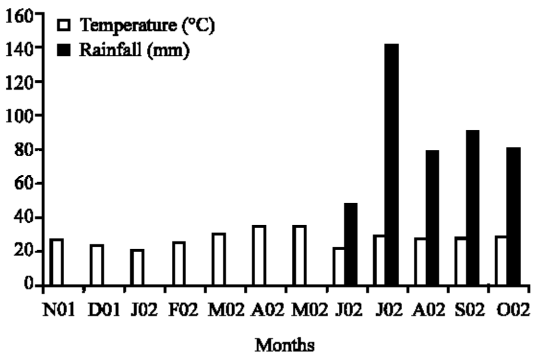

Fig. 1: Climatic data of Ndjamena (CHAD) from November 2001 to October 2002. Meteorological Centre Asecna, Ndjamena airport

length (mm) measured. The sex was determined by dissection before storing either in a freezer (5°C) or in a formalin solution (10%) until further examination. During the study, the specimen were thawed or removed from the formalin solution and abundantly washed in tap water. The external (eyes, skin, operculum, gills) and internal organs (digestive tube, gall bladder, liver, ovaries and kidney) were observed under stereomicroscope after Fomena *et al.* (2000). The different parasites species were identified with a light microscope following criteria defined by Lom and Athur (1989) and Fomena *et al.* (1994). Fish were grouped into six classes of 20 mm amplitude. The prevalence (Pr), average intensity (AI), intensity (I) were defined following Margolis *et al.* (1982). A parasite species was considered frequent (common or principal) if $Pr > 50\%$, secondary or intermediary if $10\% \leq Pr \leq 50\%$ and rare or satellites if $Pr < 10\%$ according to Koskivaara and Valtonen (1992) and Valtonen *et al.* (1997) and the intensity was judged very weak if $I < 10$, weak if $10 \leq I \leq 50$, average if $50 \leq I \leq 100$ and very high if $I > 100$ following Bilong Bilong and Njiné (1998). Rates of infection were compared using the χ^2 test. The correlation coefficient between the cystic load and the host length was calculated. Otherwise other mention, the level of security adopted is 95% ($p<0.05$).

RESULTS

During this work 360 specimens of each host species were examined. Their size (LS) varied from 70 to 210 mm and their weight from 14.90 to 224.30 g. The fish were placed in 6 size classes, the modal being (110-130) (Fig. 2). The sex-ratio for both Cichlids were favourable to males with the values 2.1 and 2.0 for *O. niloticus* and *S. galilaeus*, respectively.

It was observed that *O. niloticus* and *S. galilaeus* were each infected by 11 myxosporean species of the

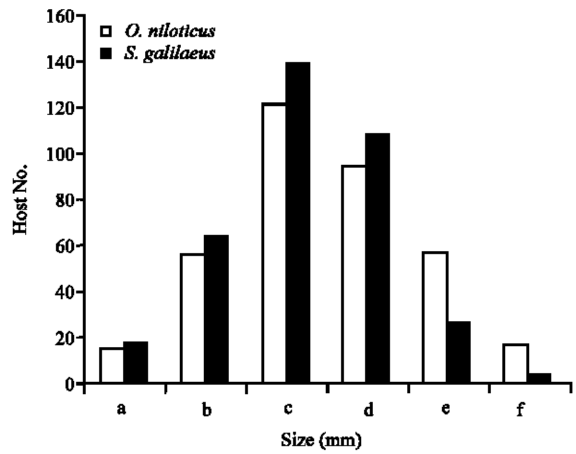

Fig. 2: Host distribution (*O. niloticus* and *S. galilaeus*) as a function of the size class

genus *Myxobolus* Bütschli, 1882. These parasites shared the same status in both xenocommunities (component communities) except for *M. kainjiae* which were rare in *O. niloticus* and secondary in *S. galilaeus* in one hand and in the other hand *M. camerounensis* which were frequent and secondary in these hosts, respectively (Table 1). Thus, in the above named *Myxobolus*, the frequent species ($Pr>50\%$) group was represented by *M. agolus, M. brachysporus, M. cichlidarum, M. heterosporus, M. clarii and M. tilapiae*; while the secondary species ($10\% \leq Pr \leq 50\%$) were made up of *M. equatorialis* and *M. nyongana*, lastly *M. israelensis* was rare ($Pr < 10\%$) (Table I). It was noted that the infracommunities were composed of 4 to 9 different species in *S. galilaeus* and 5 to 9 different ones in *O. niloticus*. Also, the host frequency distribution was identical i.e., fish habouring seven (7) different parasites species (150 *O. niloticus* and 149 *S. galilaeus*) represented the modal classes (Fig. 3).

Despite the precaution taken to realize a buttonhole allowing the diffusion of formalin into the abdominal cavity, there was still rupture of the spleen in most individuals. So this organ was not considered in this work. In both host species, the parasites collected were placed in five (5) categories depending on their infection sites (Table 2). Secondary (*M. equatorialis* and *M. nyongana*) and rare (*M. israelensis*) pathogens only parasitized a single organ (kidney) or ovaries for *M. kainjiae*, contrary to *M. camerounensis* also secondary in *S. galilaeus* found in four different sites. It was noted that 4 of the 6 (67%) and 5 of the 7 (71%) common *Myxobolus* species in *S. galilaeus* and *O. niloticus* respectively colonised 3 and 4 organs, while *M. clarii* had the largest number of target organs (5).

Table 1: Parasite prevalence and cystic load in both host species

	Host		Species		
	Oreochromis niloticus		*Sarotherodon galilaeus*		
Parasite species	Prevalence (%)	Cyst No. (min-max) $\bar{X}$, s, n	Prevalence (%)	Cyst No. (min-max) $\bar{X}$, s, n	Comparison between host species
M. agolus	99.17	-	95.27	-	$\chi^2 = 10.08$ p<0.05
M. brachysporus	96.67	-	94.44	-	$\chi^2 = 2.10$ NS
M. camerounensis	50.55	(1-20) 3.84 ; 3.62; 139	42.78	(1-36) 4.5; 5.5; 123	$\chi^2 = 4.38$ p<0.05
M. clarii	91.95	(1-85) 6.27; 6.12; 219	94.16	(1-40) 8.1; 7.0; 242	$\chi^2 = 1.38$ NS
M. equatorialis	13.30	-	20.00	-	$\chi^2 = 5.76$ p<0.05
M. heterosporus (type 3)	97.50	-	97.50	-	$\chi^2 = 1.16$ NS
M. israelensis	8.61	-	5.00	-	NS
M. kainjiae	6.94	-	16.94	-	NS
M. nyongana	19.44	(1-5) 2.9; 1.8; 8	19.16	(1-15) 3.7; 3.2; 58	$\chi^2 = 1.14$NS
M. cichlidarum	99.72	-	100.00	-	p<0.01
M. tilapiae	86.11	(1-19) 3.50; 3.14; 58	90.11	(1-11) 3.4; 2.63; 50	$\chi^2 = 3$ NS

Pr>50%: common species ***; 10% ≤ Pr≤ 50%: secondary or intermediary species **; Pr<10%: rare or satellite species *

Table 2: Infected organs spectrum and the infection rate in *O. niloticus*/*S. galilaeus*

	Organs examined								
Parasite species	Gill	Fin	Liver	Gall bladder	Ovaries	Kidney	No. of infected organ	χ^2	Signification (P)
M. ago	-	-	39.2/41.9	99.2/42.5	-	99.2/95.3	3	523.8/269.7	p<0.001
M. bra	-	-	34.2/12.2	38.6/13.6	-	91.8/97.5	3	268.0/661.7	Idem
M. cam	25/23.6	16.9/12.2	2.8/8.8	-	-	44.7/36.9	4	186/107.0	Idem
M. cic	-	-	47.2/52.7	50.5/56.9	4.7/4.2	100/99.7	4	656.1/662.8	Idem
M. cla	32.2/50	41.9/40.3	36.6/38.6	39.2/49.3	-	44.7/90.3	5	308/331.6	Idem
M. equ	-	-	-	-	-	13.3/20	1	ND	ND
M. het	-	-	-	-	-	96.6/97.5	3/1	ND	ND
M. isr	-	-	-	-	-	8.6/5	1	ND	ND
M. kai	-	-	-	-	-/20	16.6/-	1	ND	ND
M. nyo	5.9/16.1	-	-	-	-	2.8/16.4	1	358.6/ND	p<0.001/ND
M. til	-	-/13.3	-	-	-	15.5/86.1	2	ND/350.3	ND/p<0.001

I<10: very low; 10 ≤ I ≤ 50: low; 50< I ≤ 100: average; I > 100: high; X: mean; s: standard deviation; n: number of harbouring 1cyst at least; -: no cyst, NS: Not Significantly different; ND: Not Determined

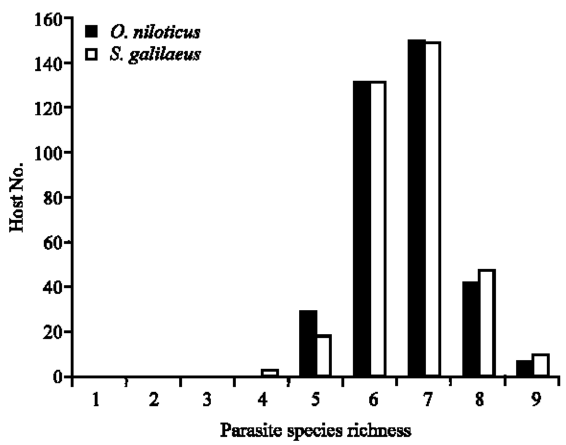

Fig. 3: Host distribution (*O. niloticus* and *S. galilaeus*) as a function of the myxosporean species richness

For all myxosporeans observed in more than one site, the infection rates significantly differed (p<0.001) between organs, the kidney being most often attacked except for *M. nyongana* in the case of *O. niloticus* (Table 2). For all frequent *Myxobolus* species, the infection rates of the two cichlids in the Chari River (Chad) were relatively high (Pr>50%) in all host cohorts, except for *M. camerounensis* and *M. clarii* where the infection rate of a given size group, especially in *S. galilaeus*, rarely reached 50% (Table 3). Also, the parasitism (%) did not statistically differ (p<0.05) with the host age, except for *M. clarii* in *O. niloticus* ($\chi^2 = 17.18$; ddl = 5; p<0.05). Fish with size 110 to 170 were most frequently infected than those of the other classes. Amongst the parasites collected, only four species encysted in some organs, namely *M. camerounensis* (in gills, fins, eyes and skin), *M. nyongana* (in gills), *M. clarii* (in gills and fins) and *M. tilapiae* (in fins). Their individual cystic load was very weak (I<10 cysts/host) or weak (10 ≤ I ≤ 50 cysts/host) and the average load for a given host species also remained very weak. However, it was noticed (a) that one *O. niloticus* specimen of 160 mm long had accumulated 85 *M. clarii* cysts and (b) that *M. nyongana* formed not more than 5 cysts in one host individual but appeared as diffused spores in the kidneys. Since there were no uniform linear evolution between the host size and the myxosporean cystic load, no significant correlation was found. Hereafter, only common species, which structure the communities (Combes, 1995), were considered for

Table 3: Infection rate as a function of the host size class *(O. niloticus // S. galilaeus)*

	Parasite species						
Size class (mm)	*M. ago*	*M. bra*	*M. cam*	*M. cic*	*M. cla*	*M. het*	*M.til*
a	100//94.4	100//100	46.6//38.8	100//100	40//33.3	100//100	100//66.6
b	100//98.4	100//95.3	60.7//46.8	100//100	39.3//45.3	96.4//96.8	85.7//90.25
c	100//96.4	95//97.7	45.4//40.3	99.1//100	61.9//39.5	99.1//97.8	91.7//89.2
d	96.8//94.4	93.6//95.3	47.8//42.6	100//100	67.7//41.6	95.7//98.1	92.5//87.6
e	100//85.19	100//85.2	61.4//44.4	100//100	56.1//45.8	98.2//100	85.9//51.8
f	100//100	100//100	35.3//75	100//100	38.8//25	94.1//50	82.3//75

In the expression a// b, a and b represent the infection rate for *O. niloticus* and *S. galilaeus*, respectively

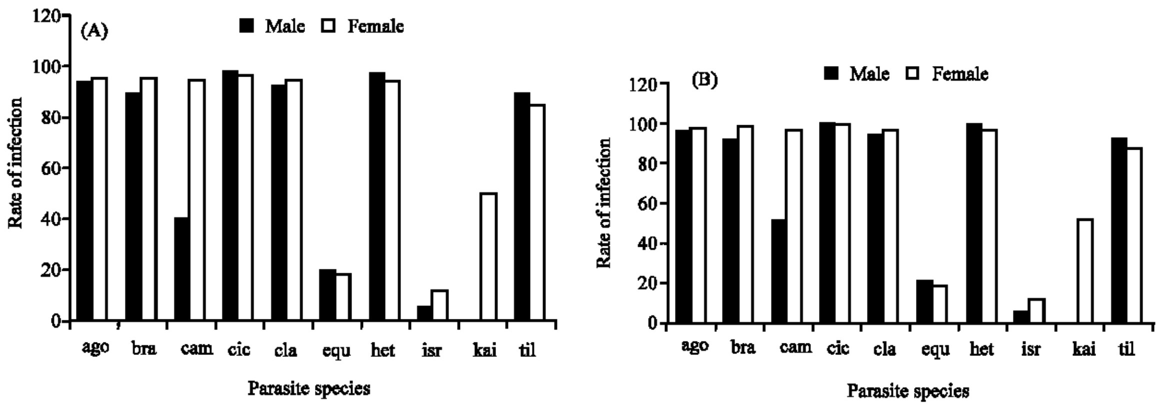

Fig. 4: Parasitism (%) as a function of the sex of *O. niloticus* (A) and *S. galilaeus* (B)

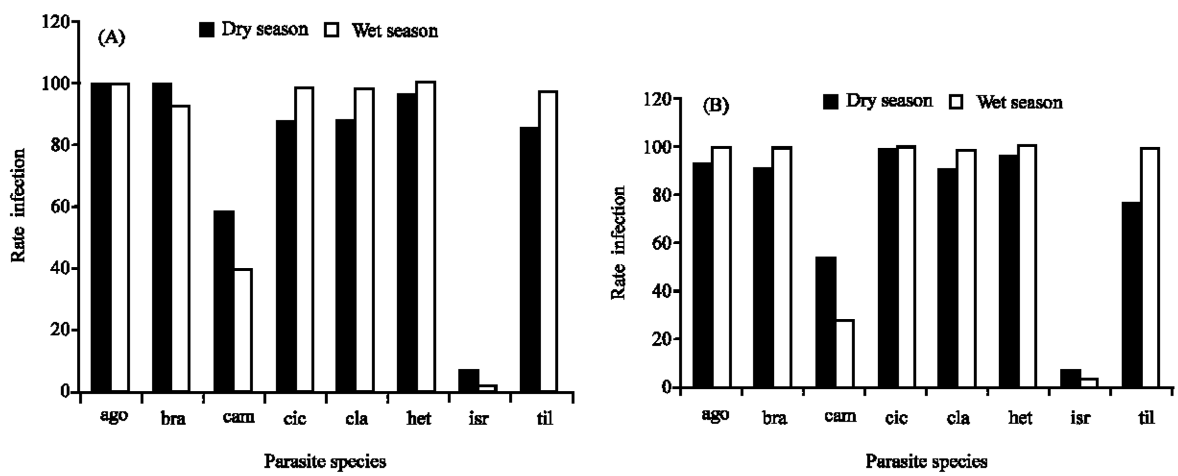

Fig. 5: Parasitism (%) as a function of the season in *O. niloticus* (A) and in *S. galilaeus* (B)

further analysis, limited to the variation of infection rate. In general, the infection rates of myxosporean were similar ($p>0.05$) in both male and female. But *M. brachysporus* and *M. camerounensis* were more often present ($p<0.05$) in females (Fig. 4A) and in males (Fig. 4B), respectively than in the other sex. Although not common species, it was noticed on the one hand that, *M. equatorialis* more frequently ($p<0.05$) parasitized kidneys in *O. niloticus* females (Pr = 20.30%) than in males (Pr = 9.9%) (Fig. 4B) and on the other hand that *M. kainjiae* only affected the ovaries with the prevalences Pr = 21.2% in *O. niloticus* and Pr = 51.26% in *S. galilaeus* (Fig. 4).

The myxosporeans also revealed three patterns or categories of occurrence (Fig. 5). *M. brachysporus* and *M. camerounensis* appeared more frequently in *O. niloticus* during the dry season i.e., from November 2001 to May 2002 (category A); while *M. agolus*, *M. brachysporus*, *M. clarii* and *M. tilapiae* in *S. galilaeus* and *M. cichlidarum*, *M. heterosporus*, *M. clarii* and *M. tilapiae* in *O. niloticus* were more prevalent in the wet season i.e., from June 2002 to October 2002 (category B). For *M. cichlidarum* and *M. heterosporus* in *S. galilaeus* and *M. agolus* in *O. niloticus,* the infection rates did not vary significantly (p>0.05) with the season (category C).

DISCUSSION

In the natural environment *O. niloticus* and *S. galilaeus* presented a polyparistism by Myxosporea in the Chari River, in general these pathogens had the same status and were common in these host species. Obiekeze and Okaeme (1990) in Nigeria and Fomena (1995) in Cameroon also found these protozoans in the same organs of the fish species. It is thought that in a polycultural situation, a potential disastrous explosion can easily occur due to the parasite transfer. It is already known that Tilapia of Nil (*O. niloticus*) is a bit aggressive to other Tilapia species (Balarin and Hatton, 1979) and occasionally eliminate them in African ponds (Moreau *et al*., 1988).

Myxobolus nyongana found in *O. niloticus* and *S. galilaeus* was earlier described from diverse *Barbus* species (Cyprinidae) in Cameroon (Fomena, 1995), then in *Sarotherodon melanotheron* (Cichlidae) in Benin (Sakiti *et al*., 1991), in *Alestes dentex* (Characidae) and *L. parvus* (Cyprinidae) in Chad (Kostoingue and Toguebaye, 1994). So it is euryxenous i.e., large host specific (Euzet and Combes, 1980). Eleven and eight of the 19 Myxosporea described in Cameroon revealed stenoxenous (narrow host specific) and oioxenous (strict host specific) respectively (Fomena, 1995). Myxosporeans are known to be generally wide host specific, but frequently some fish are preferred over others (Schulman, 1966). Neither Myxosporean parasites of genus *Sphaerospora* Thelohan, 1892 nor Microsporea were observed in the cichlids in Chari. It is thought that secondary and rare pathogen species in this work can change their status in other hosts of this ecosystem. Similarly, Brummer-Korvenkontio and Pellitero (1991) argued that accidental or less common Myxosporea species in the roach (*Rutilus rutilus*) in Central Finland may occur more commonly in other Cyprinid species. In the Chari River, the cystic load appeared relatively low in both fish species irrespective of the pathogen concerned and *S. galilaeus* was more often affected by the vegetative form of *M. nyongana* than *O. niloticus.* In ponds Obiekezie and Okaeme (1990) found the prevalence of myxosporean parasites high in some African tilapia species (certainly because the fish overcrowded the basins), while the individual and average spore intensities in melanomacrophage centers (spleen and kidney) were very low or low. They also failed to observe differences in the infection (prevalence and intensity) between these cichlids. In stocking conditions also, Fomena (1995) recorded in average a relatively low cyst loads for *O. niloticus* myxosporean parasites; but in a watercourse, Tombi and Bilong Bilong (2004) noted that specimens of *Barbus martorelli* (Cyprinidae) can harbour 1 to 1913 cysts of *M. barbi* (average:101.6) and 1 to 65 cysts of *M. njinei* (average: 8.5). In Lake Nokoué (Benin) the prevalence of *Myxobolus* sp. and *M. zillii*, branchial parasites of *Sarotherodon melanotheron melanotheron* and *Tilapia zillii*, was 14.86 and 20.20%, respectively, although Gbankoto *et al*. (2001) considered it high. In this work, the infection rate for almost all pathogens remained unchanged between host cohorts, certainly due to a relatively high host density following the wet season which can favor equal parasite recruitment. But the higher prevalence of *M. clarii* in medium size fish (*O. niloticus*) can be explained by the accumulation in time of the parasite spores, especially in kidneys; the low number of longer fish examined can justify the low infection rate in this class by *M. clarii*. No significant correlation between any parasite cystic load and the host size was noted in this study. Obiekezie and Okaeme (1990) also noted that all age classes of *O. niloticus* and *S. galilaeus* were equally susceptible to parasitism. Tombi and Bilong Bilong (2004) on the contrary found that younger *Barbus martorelli* habour more myxosporean cysts than older ones. The parasites of *Rutilus rutilus* (*M. rhodei* and *M. pseudodispar*) showed a tendency to prevalence reduction in old hosts due to the increase of the immunitory response with the age of the fish (Brummer-Korvenkontio and Pugachev, 1991). In Spain, Sitja-Bobadilla and Alvarez-Pellitero (1993) observed a progressive increased of *Dicentrarchus labrax* infection (prevalence) by *Sphaerospora dicentrarchi* with host age while in Argentina, Viozzi and Flores (2003) found a positive significant correlation between the prevalence of *Myxidium biliare* and its host size (*Galaxias maculatus*: Galaxiidae). The prevalence of *M. zillii* and *M. dossoui* did not vary significantly with host size although peaks were observed in larger size classes (Gbankoto *et al*., 2001). In this work, no sex effect was noted in the infection rate of any parasite species; similar observations were made for *M. agolus, M. israelensis, M. sarigi* and *Sphaerospora melenensis* which infect the kidney and spleen of *O. niloticus* (Fomena, 1995). Gbankoto *et al.* (2001) also found the sex difference irrelevant in the infection of *S. m. melanotheron* and *O. niloticus*. In *Galaxias maculatus* the infection by spores of *M. biliare* was independent of host sex, this appeared the typical situation in myxosporidiosis (Viozzi and Flores, 2003). However, in a watercourse, Tombi and Bilong Bilong (2004) revealed that females' *B. martorelli* are much often parasitized by *M. njinei* than males due to their aggregation (about 10 individuals per group) during spawning-time; at this period females hide in small rock excavations becoming easy targets for actinospores. Moreover, the knowledge of parasite (*M. brachysporus* and *M. camerounensis*) and the host (*S. galilaeus* and *O. niloticus)* biology could help to better explain the differences in infection rates observed between both sexes. The exclusive preference to ovaries by *M. kainjiae* is still ecologically questionable. However, it is known that this pathogen poses potentially serious implications for the reproductive efficiency of *O. niloticus* and *S. galilaeus* due to its direct infection and destruction of mature eggs (Obiekezie and Okaeme, 1990). The relation parasitism/season made it possible to define 3 categories (A, B and C) of pathogens. Parasites of category A highly occurred in the wet season (4 species in both Cichlids). It is thought that during the wet season, annelids (Oligochaeta in particular) which are intermediate potential hosts (Kent *et al*., 2001) are very abundant and the infecting stages (actinospores) multiply in water and favour the fish infection. In rivers with tropical regime presenting a large major bed and vast flooding zones (Niger, Chari, Logone, Zambeze), the rise of the tide offers enormous areas to fish and induces lateral migrations of many species. On the arrival of water on the earth, the organic and mineral matter which accumulated in the dry season is immediately made soluble; this is followed by a phytoplankton and a zooplankton proliferation. An abundant periphyton (algae) and an associated fauna also develop (Blache, 1964; Lauzanne, 1988). Myxosporea of category B are more frequent in the dry season (2 species in *O. niloticus*). It is thought that during water evaporation, fish hosts become more infected by absorbing the spores deposited on the mud; the latter may also eject their polar filaments and directly infect hosts (fish) feeding at this level. In fact, *Sarotherodon* and *Oreochromis* are macrophage filters i.e., they essentially ingest phytoplankton and feed on the detrital pellicle of the silt rich in deposited algae (Lauzanne, 1988). Therefore, the host biology seems to favour their infection and myxosporean actinospores of this species category could better support water high temperature. In order to compare probabilities of myxosporean transmission to their fish hosts, Schulman (1984) proposed a taxonomical separation of Myxosporea based on the sedimentation speed of these parasite spores. Obiekezie and Okaeme (1990) equally estimated that high water temperature and mud favour fish infection by Myxosporea. Thus, it is thought that the infection mostly realizes by sedimented spores or those found on filtered algae thereby ensuring the second infection modality after Kent *et al.* (2001). The waters in Chari and Logone are polluted due to industries, soap-making and sugar factories, in the Moundou and Sarh cities, respectively (Tchadanaye *et al*., 2005). It is suggested that during evaporation phenomenon in the dry season, this pollution could (a) be more intense and (b) negatively affect the parasite infecting stages. In Benin, the seasonal pattern of prevalence, which only vary significantly for species affecting the branchial filaments (*Myxobolus* sp. and *M. zillii*) could not be explained directly by temperature variations, but by the combination of fluctuations in salinity, temperature and pH between dry and wet seasons which affects the parasite cycle, by modifying the contact zone between the parasites and their hosts (Gbankoto *et al*., 2001). Bilong Bilong and Tombi (2005) failed to observe seasonal difference in the infection of *B. martorelli* by *M. barbi* and *M. njinei* in the Foulou water-course. In the temperate zone, Brummer-Korvenkontio *et al.* (1991) did not find any seasonality in the occurrence of myxosporean parasites of *Rutilus rutilus* living in four lakes. In the contrary, Sitja-Bobadilla and Alvarez-Pellitero (1993) revealed that the prevalence of *S. dicentrarchi*, parasite of *D. labrax* (Serranidae), positively correlates with water temperature in ponds: it is higher in summer and lower in autumn. But in wild host populations, no statistical fluctuation of parasitism is noted. In an oligotrophic lake (Argentina), Viozzi and Flores (2003) also revealed that the prevalence of *Myxidium biliare*, parasite of gall bladder and the rate of immature plasmods increase to the maximum in summer and reduce in winter.

In the identification key of myxosporean genera, Fomena and Bouix (1997) precised the sites of infection of all parasites. In this work it was noted that: some pathogens enlarge their organs spectrum from 3 to 5 for some common species. These parasites diffuse in the whole body of the individual host. It is the case of *M. sarigi*, so far known in the kidney and spleen of diverse Cichlids (Fomena and Bouix, 1997). This pathogen is also found in the liver, ovaries and in the gall bladder of *O. niloticus* and *S. galilaeus* in Chad. *Myxobolus clarii* described from the testis of *Clarias lazera* in Egypt (Mandour *et al*., 1993) is rather observed in gills, liver, ovaries and gall bladder of the Cichlids studied in Chad. Finally, *M. brachysporus* collected from the kidneys in diverse Tilapias in Cameroon (Fomena, 1995) also parasite the gall bladder and the liver of *O. niloticus* and *S. galilaeus* in the Chari river (Chad).

In *O. niloticus* and *S. galilaeus*, the kidneys (first) and the gall bladder (second) are preferential sites for parasites. Obeikezie and Okaeme (1990) equally showed that Myxosporea parasites of Tilapia have preferential infection sites despite their general distribution in the tissues. Brummer-Korvenkontio *et al*., (1991) also noted the dispersal character of different myxosporean species spores which use the blood stream to reach the kidneys, other organs and cavities causing accidental infections. Although the spores load was not evaluated in this work, their intensity per organ appeared very high and could dangerously lead to disasters even in the wild. Fomena (1995) expressed the same worries for *O. niloticus* individuals of the Melen Fish Farm. For, it is known that: a)-these organisms attack the spleen in thisichlid and lead to severe anemia (Faisal and Shalaby, 1978); b)- *M. heterosporus* could provoke spleen and liver damages in many Cichlids (Baker, 1963); c)- *M. sarigi* could be pathogenic to hosts (Okaeme *et al*., 1988); d)- other species as *Sphaerospora renicola* affect the renal tubules of cyprinid fries provoking their dilatation, atrophy and epithelium necrosis (Lom and Dykova, 1992). Ellis *et al.* (1978) indicated that in teleosteans, the kidney is a mixed organ with haematopoietic, reticulo-endothelial, endocrine and excretory roles; its infection could therefore cause dangerous dysfunctions for the individual hosts.

CONCLUSIONS

The present research had shown a polyparasitism of *O. niloticus* and *S. galilaeus* by myxosporeans in the Chari River. It could be a general phenomenon in African Cichlids, favoured by the tendency of these pathogenic agents to enlarge their hosts spectrum and target organs. The study of the parasitism of *O. niloticus* and *S. galilaeus* had only considered the enumeration of parasite cysts; in general, it showed a very weak cystic load due to the water pollution. However, the high spore intensities in different organs could in ponds be very damageable. These host species, already in the natural conditions, ensure a bilateral transfer the myxosporean fauna. It becomes a parasitological argument to advice fish farmers against rearing of these two cichlid species in polycultures; moreover, they are not compatible. In the Chari ecosystem, these host species infection neither depend on the sex, nor on the age (size) of individuals; for, all fish cohorts are similarly infected. Regarding the seasonal occurrence of the pathogens here studied, only *M. cichlidarum* and *M. heterosporus* appeared indifferently in the wet and the dry seasons.

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