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Monthly occurrence of nematode parasites of *Synodontis* species from rivers Niger-Benue confluence at Lokoja, Nigeria

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Abstract

This study was carried out to evaluate the monthly distribution of nematode parasites of *Synodontis* fish species between March 2014 and February 2015. A total of 484 fish hosts were examined for nematode parasites microscopically using sedimentation method. A total of 326 (67.4%) were infected by nematode parasites. Five species of nematodes were encountered: *Procamallanus laevionchus* (37.81%, 183 fishes), *Rhabdochona congolensis* (15.08%, 73 fishes), *Spinitectus guntheri* (19.42%, 94 fishes), *Camallanus* spp (31.20%, 151 fishes) and *Contraecaecum* spp (14.05%, 68 fishes) and larval nematodes (1.65%, 8 fishes). The highest prevalence of 57.9% and mean abundance of 11 were recorded by *Camallanus* spp in October and August respectively. Monthly variation in prevalence revealed that *P. laevionchus* was highest in July. There was significant difference in infections of nematode parasites between rainy and dry seasons ($P < 0.05$). The nematode parasites of *Synodontis* fish species are of high prevalence at the confluence of River and Benue.

Keywords: *Synodontis* species, nematodes, monthly occurrence, rivers Niger-Benue confluence

Introduction

Synodontis species (catfish), with the highest number of species among Mochokid fish family, occur throughout the Afro-tropical region [1]. They are abundant in Rivers Niger and Benue at the Confluence area in Lokoja, particularly during the rains and contribute significantly to subsistence fishing [2]. Among the riverine populace, they are a delicacy and a source of scarce animal protein and minerals. Most *Synodontis* species are benthopelagic freshwater fish that feed on worms, crustaceans, detritus, seeds and decaying vegetable matter which they sift out of mud [3]. Because of their feeding habit, *Synodontis* species are reported to be associated with a number of parasites, mostly gut helminths [4-6].

Nematode parasites constitute one of the major cause of lose in income value of fish as it is quite common to see the stomach worms leave their hosts via the mouth or gills and those in the intestine wriggle out through the anus [7]. While there are several reports on parasite prevalence, mean intensity and abundance of some commercially important *Synodontis* species, little exists on the monthly occurrence of the common parasites. Reports of some freshwater fish species showed some parasites exhibited marked seasonality in prevalence, mean intensity and mean abundance while others had no defined seasonal peak of infection [8-15]. Factors such as water temperature, water volume, parasite life cycle and fish diet are implicated in the seasonality of parasites. This study evaluates the monthly distribution of nematodes parasites of *Synodontis* fish species of Rivers Niger and Benue at the Confluence area.

Materials and Methods

The study was carried between March 2014 and February 2015.

Study Area

The study area was carried out around the confluence of the two major rivers in Nigeria, River Niger and River Benue between latitude 7° 45' N to latitude 8° 12' N and longitude 6° 39' E to longitude 7° 00' E (Fig. 1). The area has two major seasons; the dry season and wet season. The wet season begins from March to October or November while the dry season begins from November to March.

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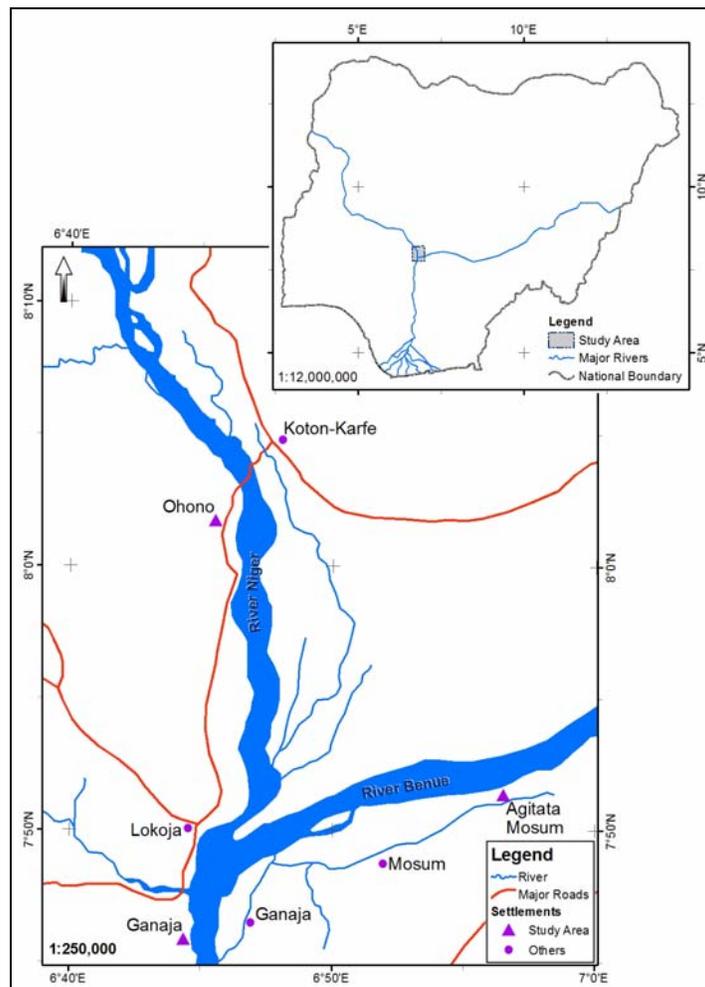
Fish Sample Collection

Fish were sampled from fishers in the three sampling locations using a variety of fishing gears for 12 months.

Locality 1: Ohono village, along Lokoja - Koton Karfe road, (Niger River).

Locality 2: Mozum village, located on the eastern bank, (Benue River).

Locality 3: Ganaja village, below the confluence of the two rivers, (confluence)



Source: Shell Petroleum Development Map of Nigeria (2000).

Fig 1: Map of the Study Area Showing the Confluence of Rivers Niger and Benue at Lokoja, Nigeria.

Parasites Isolation and Identification

The fish species were identified according to Reed [1] and Olaosebikan and Raji [2]. Sampled fish from each locality were examined for parasites. Examination of fish for parasites followed methods of Marcogliese [17]. Ash and Orihel [18] method for treatment, fixation and preservation was used while identification of parasites was based on Yamaguti [19] and FAO [20].

Statistical Analysis

Infection statistics Bush *et al.* [21] was used for to calculate the prevalence, mean intensity and abundance of parasites using SPSS version 21. Also, T-test was used to calculate the significant levels of wet and dry season infections.

Results

A total of 484 fish hosts, comprising of *Hemisynodontis membrenaceus* (3), *Synodontis batensoda* (84), *Synodontis curteti* (3), *Synodontis eupterus* (3), *Synodontis filamentosus* (2), *Synodontis goroni* (2), *Synodontis nigrita* (20), *Synodontis obesus* (31), *Synodontis ocellifer* (2), *Synodontis omias* (13),

Synodontis resupinatus (25), *Synodontis robbianus* (31), *Synodontis schall* (193), *Synodontis sorex* (64) and *Synodontis violaceus* (9) were examined. 326 (67.4%) were infected with a total of 6534 nematode parasites recovered.

Species of nematodes encountered included *Procamallanus laevionchus*, *Rhabdochona congolensis*, *Spinitectus guntheri*, *Camallanus* spp. and *Contracaecum* spp. *P. laevionchus* had the highest prevalence of 37.81% (183 fishes), which is not significant ($p > 0.05$) from *Camallanus* spp with prevalence of 31.20% (151 fishes). Larval nematodes had the least prevalence of 1.65% (8 fishes). Others infected thus; *S. guntheri*, 19.42% (94 fishes), *R. congolensis*, 15.08% (73 fishes) and *Contracaecum* spp, 14.05% (68 fishes) (Table 1).

Infections by nematode parasites generally occurred throughout the year with highest prevalence during the rainy months. *P. laevionchus*, *S. guntheri* and *Camallanus* spp. had the highest prevalence of 49.28%, 34.78% and 50.72% in August while *R. congolensis* and *Contracaecum* spp was highest in June (32.08%) and October (39.47%) respectively (Fig. 2).

There was significant difference between the infections in the

rainy season ($P < 0.05$) and dry season except the larval nematodes which were found only in the months of March, September and October with very low prevalence (Table 3). *P. laevionchus* was the highest nematode parasite recovered with a total of 2430 parasites and mean intensity of 5.02, while

R. congolensis had the least parasite load of 413 with mean intensity of 0.85 (Table 2, Fig. 3). Examination of *Synodontis* fish species revealed that nematode parasites, mostly adult worms were found in the intestines, except a few larval ones recovered from the visceral cavity and liver of fish hosts.

Table 1: Monthly Prevalence of Nematode Parasites of *Synodontis* spp. in the River Niger-Benue Confluence, Lokoja

Months	Number of Fish Examined	Number Positive (%)					
		<i>P. laevionchus</i>	<i>R. congolensis</i>	<i>S. guntheri</i>	<i>Camallanus</i> spp.	<i>Contracaecum</i> spp.	Larval nematodes
March	13	4 (30.77)	2 (15.38)	0 (0.00)	0 (0.00)	1 (7.69)	3 (23.08)
April	34	16 (47.06)	6 (17.65)	3 (8.82)	5 (14.71)	1 (2.94)	2 (5.88)
May	36	16 (44.44)	10 (27.78)	0 (0.00)	9 (25.00)	3 (8.33)	0 (0.00)
June	53	23 (43.40)	17 (32.08)	13 (24.53)	23 (43.40)	5 (9.43)	0 (0.00)
July	42	16 (38.10)	7 (16.67)	13 (30.95)	2 (4.76)	5 (11.90)	0 (0.00)
August	69	34 (49.28)	7 (10.14)	24 (34.78)	35 (50.72)	7 (10.14)	0 (0.00)
September	53	19 (35.85)	3 (5.66)	12 (22.64)	20 (37.74)	9 (16.98)	2 (3.77)
October	38	13 (34.21)	6 (15.79)	5 (13.16)	22 (57.89)	15 (39.47)	1 (2.63)
November	27	9 (33.33)	1 (3.70)	6 (22.22)	5 (18.52)	9 (33.33)	0 (0.00)
December	30	5 (16.67)	4 (13.33)	3 (10.00)	6 (20.00)	3 (10.00)	0 (0.00)
January	47	16 (34.04)	7 (14.89)	9 (19.15)	11 (23.40)	10 (21.28)	0 (0.00)
February	42	12 (28.57)	3 (7.14)	6 (14.29)	13 (30.95)	0 (0.00)	0 (0.00)
Total	484	183 (37.81)	73 (15.08)	94 (19.42)	151 (31.20)	68 (14.05)	8 (1.65)
	Chisquare	14.785	26.609	32.957	59.231	45.188	47.953
	Df	11	11	11	11	11	11
	P value	0.193ns	0.005**	0.001**	0.000**	0.000**	0.000**

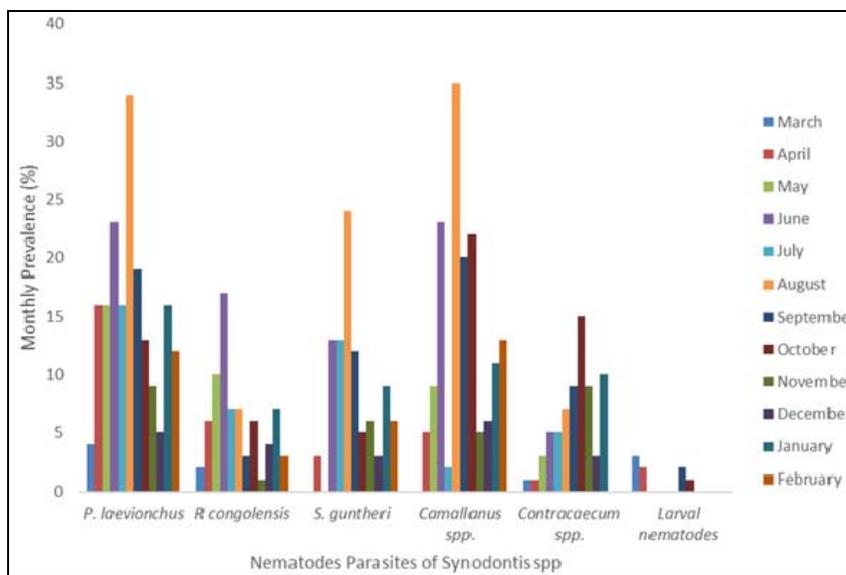


Fig 2: Monthly Infection of Nematodes of *Synodontis* spp. in the River Niger-Benue Confluence, Lokoja.

Table 2: Monthly Abundance and Mean Intensity of Nematode Parasites of *Synodontis* spp. in the River Niger-Benue Confluence, Lokoja

Months	Number of Fish Examined	Abundance of Parasites (Mean Intensity)					
		<i>P. laevionchus</i>	<i>R. congolensis</i>	<i>S. guntheri</i>	<i>Camallanus</i> spp.	<i>Contracaecum</i> spp.	Larval nematodes
March	13	16 (1.23)	16 (1.23)	0 (0.00)	0 (0.00)	3 (0.23)	10 (0.77)
April	34	129 (3.79)	31 (0.91)	14 (0.41)	78 (2.29)	3 (0.09)	20 (0.59)
May	36	281 (7.81)	47 (1.31)	0 (0.00)	50 (1.39)	79 (2.19)	0 (0.00)
June	53	413 (7.79)	180 (3.40)	276 (5.21)	276 (5.21)	32 (0.60)	0 (0.00)
July	42	428 (10.19)	25 (0.60)	164 (3.90)	50 (1.19)	17 (0.40)	0 (0.00)
August	69	483 (7.00)	21 (0.30)	297 (4.30)	759 (11.00)	41 (0.59)	0 (0.00)
September	53	254 (4.79)	16 (0.30)	58 (1.09)	292 (5.51)	42 (0.79)	48 (0.91)
October	38	87 (2.29)	15 (0.39)	19 (0.50)	217 (5.71)	46 (1.21)	4 (0.11)
November	27	81 (3.00)	3 (0.11)	32 (1.19)	78 (2.89)	197 (7.30)	0 (0.00)
December	30	63 (2.10)	18 (0.60)	6 (0.20)	33 (1.10)	9 (0.30)	0 (0.00)
January	47	103 (2.19)	33 (0.70)	132 (2.81)	99 (2.11)	71 (1.51)	0 (0.00)
February	42	92 (2.19)	8 (0.19)	21 (0.50)	118 (2.81)	0 (0.00)	0 (0.00)
Total	484	2430 (5.02)	413 (0.85)	1019 (2.11)	2050 (4.24)	540 (1.12)	82 (0.17)

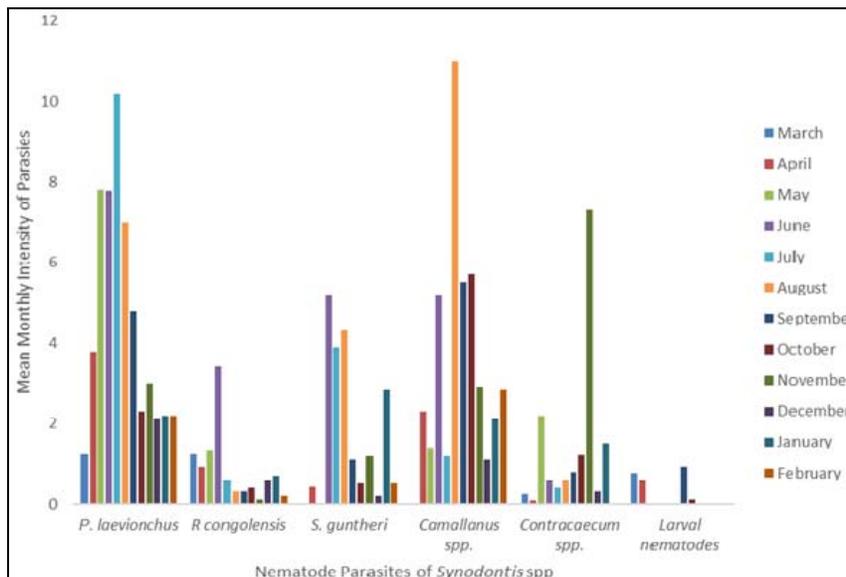


Fig 3: Monthly Abundance of Nematodes of *Synodontis* spp. in the River Niger-Benue Confluence, Lokoja.

Table 3: Seasonal Prevalence of Nematodes of *Synodontis* spp. in the River Niger-Benue Confluence, Lokoja.

Parasites	Season		Total
	Wet	Dry	
<i>P. laevionchus</i>	137 (74.86)	46 (25.14)	183 (37.81)
<i>R. congolensis</i>	56 (76.71)	17 (23.29)	73 (15.08)
<i>S. guntheri</i>	70 (74.47)	24 (25.53)	94 (19.42)
<i>Camallanus</i> spp.	116 (76.82)	35 (23.18)	151 (31.20)
<i>Contracaecum</i> spp.	45 (66.18)	23 (33.82)	68 (14.05)
Larval nematodes	5 (62.50)	3 (37.50)	8 (1.65)
Total (%)	325 (67.15)	159 (32.85)	484
	t	df	P value
	2.273	10	0.046*

Discussion

Analysis of monthly patterns of nematode parasite infections of *Synodontis* fish hosts in River Niger-Benue confluence revealed that nematode parasites were encountered throughout the year but with highest infection rates during the rainy season, April-October. Seasonal variation of parasite infection dynamics in tropical areas has been observed, [14, 15, 22] and some factors such as water temperature, increase in water volume, fish diet (feeding habit) and parasite life cycle have been implicated in the explanation of the phenomenon. Several studies have reported the occurrence of parasites throughout the year. Obiekezie *et al.* [11] reported the larval nematode *Hysterothylacium* occurred in *C. nigrodigitatus* throughout the year, with no defined peaks of intensity. Paperna [8] also reported the crustacean copepod, *Ergasilus latus* occurred throughout the year with mean monthly prevalence of 31% and a mean intensity of 4.1. The trend of parasite infection and abundance throughout the year as found with the species of nematodes in this study is consistent with the above findings. This phenomena could be attributed to temperature related dynamics and the effect on parasite lifecycle. Temperature is generally high all year round in the tropical area, encouraging all year round productivity of parasites. Choudhury and Dick [23] mention temperature as an important controlling the seasonal prevalence of Dactylogyrids and Gyrodactylids monogeneans while Granath and Esch [24], Marcogliese and Esch [17] demonstrated changes in prevalence of *Bothriocephalus acheilognathii* due temperature. Obiekezie

et al. [11] concluded that warm temperature hasten the generation time of parasites. Also, absence of seasonal variation in temperature supported the dynamic equilibrium of parasite abundance with constant infection and maturation. In the tropics and especially in the confluence area of Rivers Niger-Benue, temperature is high throughout the year with little or no fluctuations. This could explain the abundance of the nematode parasites found all year round in this study. In addition to occurrence of some parasites throughout the year, some have been reported to have their peak infection during the rainy season. Zaman [25] and Zaman and Seng [12] found increase in parasite abundance of two species of Clariid catfish coincided with increase in rainfall in Malaysia but the parasites of one specie, *C. batrachus*, showed an additional peak in the dry month of January in one of the two locations surveyed. Similarly, Akhtar *et al.* [24] observed over all higher parasite infection in *Heteropneustes fossilis* in the rainy season although their data indicated that a number of helminth species were found during the dry months. Increase in water volume could be the factor responsible for the increase in parasite abundance. In the river Benue-Niger confluence area, during the rainy months, a large volume of water contributed by river tributaries which are laden with heavy organic materials, worms and detritus flow into the rivers. This condition increases availability of both diet materials and parasites, thus enhancing productivity and parasite transmission especially in fish hosts that feed on zooplankton, macro-invertebrates and detritus [26]. Dogiel [27] and Choudhury and Dick [23] stated that parasite composition of fish gut is majorly the role of diet and habitat from which the bulk of food is obtained. According to Choudhury *et al.* [13], the richest intestinal helminth assemblages in tropical fresh water fish are generally observed in hosts with mixed carnivorous diets based on macro-invertebrates and fish. It was also argued that higher abundance of some parasites in the dry months before the rainy season in some tropical areas could be due to an increase in host density and greater overlap of intermediate and definitive hosts as water bodies shrink [28] or due to pre-spawning congregation of hosts [9], both of which facilitate transmission. Therefore, while some parasites favour transmission during the dry months, others are transmitted during the rains.

Conclusion

In the tropics and especially in the confluence area of Rivers Niger-Benue, temperature is high throughout the year with little or no fluctuations. The high prevalence of nematode parasites found in the *Synodontis* species during the rains in this study, confirmed the fact that rainy season and the interplay of temperature and diet, facilitate the transmission and acquisition of nematode parasites.

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