Original Research Article

Formatted: Tab stops: 4.31", Left

Comparative Survey of ParasitesofAfrican catfish*Clariasgariepinus*~~(Burchell, 1822)~~ inAjiwa and ZobeReservoirs inKatsina State, North-Western Nigeria

ABSRACT

Aims: The aims of this survey ~~are~~were to isolate, identify, classify and compar~~ed~~ parasitic infestation of *Clariasgariepinus* obtained from Ajiwa and Zobe reservoirs, Katsina state. Also to investigated the prevalence and infestation of African catfish (*Clariasgariepinus*) fromAjiwa and Zobe reservoirs, Katsina.

Study design:The research was conducted in Ajiwa and Zobe Reservoirs, Katsina State, Nigeria. Ajiwa reservoir is on the latitude 12°98' N and longitude 7°75' E, in Batagarawa LGA, Katsina State.Zobe reservoir is an earth-fill building completed in 1983 on the coordinates 12°23'18" N latitude and 7°28'29" E longitude in Dutsin-Ma LGA of Katsina State.

Place and duration of the study: Biological laboratory of the department of Fisheries and Aquaculture Federal University, Dutsin-Ma, Katsina State, between September, 2020 and February 2021.

Methodology:A total of 180 live fish samples of males and females of~~,~~*Clariasgariepinus;*~~consisting of males and females~~ were randomly obtained from Ajiwa and ZobeReservoirs. Theskin, the gastrointestinal tract of the fish was examined for the presence of parasite, using standard procedures. (Explain in brief)

Results: The prevalence in female specimens of *C. gariepinus* 29 (58.00%) was higher than that of the males 20 (50.00%) inAjiwa reservoir while in Zobe the prevalence in male specimens of *C. gariepinus* 22 (46.80%) was higher than that of the females 20 (46.52%).Occurrence and mean intensity of parasitic infection were higher in samples in the Zobe reservoir than those in the Ajiwa reservoir.

Conclusion: The study~~research~~ displayed thatthe parasiticburdenswere higher in *C. gariepinus*~~gotten~~ in Zobe environment compared to those obtained from Ajiwa environment. I~~t~~

~~is~~F~~f~~or that reasonit was suggested that the stomach and intestinaltractcollected ~~in~~from*C. gariepinus* from the surveyregion,have to be ~~thrown away~~properly discarded instead ~~than~~ of consumption to prevent the spread of infections from fish to human being.It would be ~~can be~~ significant to frame~~set~~up rules such as limits,continuous~~ly~~ waste dumping in addition to livestock rearing/watering activities around water bodies, that will reducepossible actions that may possiblysupporting the ~~backinga~~ growth of ~~in~~ parasitic wormsin the environs.

Key words: Zoonosis;Fish Parasites; Helminths;Ectoparasites; Endoparasites;Lakes; Dams

1. INTRODUCTION

Fish and fish products areimportantsources of omega-3fatty acids~~of animal source~~. Fish is alow-priced and areasonable source of animal protein and it is within reach of the averageresident of the majority ofnations. Demand for fish is constantlyincreasing due to~~, among other things,~~ population growth, high prices of other animal protein sources, and other health problemsassociated with the consumption of other ~~of~~ animal protein sources (Sadauki*et al*., 2022b).Tropical freshwater fishes such as *Tilapia zillii* and *Clariasgariepinus*have been reported to act as definitive or intermediate hostsfornumerousspecies of protozoan, metazoan and crustacean parasites(Ito, 2017).Parasitic infections/infestations in fish have been reported to have serious impacts on the aquaculture~~industry (aquaculture~~ production~~)~~ and its commercialsustainability. The frequency and extent of parasite infection are closely related to the environmentalsituations of thewater body and ~~generally~~ health of the fish (Ahmad *et al*.,2016).In fisheries and aquaculture, certain parasites can be highly pathogenic, resulting in high fish mortality and economic~~profit~~ loss, or even threaten the abundance and diversity of native fish species (Sadauki*et al*., 2022b).As obtainable among other animals, fish such as *Tilapia zillii* and *Clariasgariepinus*also sufferinfestation byendoparasites and ectoparasites;particularly protozoans and helminths,triggering highmortality rate. Fish parasites and diseases instituteone of the majorchallengesthreatening fish farming globally (Ito, 2017).

Edema*et al.* (2008) reported a checklist of helminth parasitic infections in fresh water fish such as *Tilapia zillii* and *Clariasgariepinus*in African countries, and number of reports have also emerged from Africa, highlighting the intensity, occurrenc~~e~~y, epidemiology and pathology of such parasitic infestations/infections. Accordance to Hussein *et al.* (2012), *Clarias*

*gariepinus*harbourseveral parasites which compriseadult Digenea; trematode metacercaria of the family *Clinostomidae* encysting in tissues; and adult Monogenea of the families Pousopothocotylidae, Dactylogyridae and Gyrodactylidae. Parasites habitually injure fish (hosts) in the wild by destroying their tissues, which may lead to secondary infection/infestation or removal of body fluid and cell fluid from the host (MSG, 2017). This researchcompared the prevalence of parasitic infestation in the sites- skin, gills, stomach and intestine among*Clariasgariepinus* obtained from Ajiwa and ZobeReservoir reservoirs, Katsina state.

Formatted: Font: Italic, Font color: Auto, English (United Kingdom)

2. METHODOLOGY

2.1 Study Area

The research was conducted in Ajiwa and Zobe Reservoirs, Katsina State, Nigeria. Ajiwa reservoir is on the latitude 12°98' N and longitude 7°75' E, in Batagarawa LGA, Katsina State. The major purpose of the reservoir is irrigation farming and water source to the general public of Katsina, Batagarawa, Mashi and Mani LGAs. The reservoir was impounded in 1973 and commissioned in 1975. The volume of the water is nearly 22,730,000 m3 (Sadauki*et al.*, 2022a). It functions as a source of profits for the bordering societies.

Zobe reservoir is an earth-fill building completed in 1983 on the coordinates 12°23'18" N latitude and 7°28'29" E longitude in Dutsin-Ma LGA of Katsina State. The reservoir has a height of 48 m, length of 360 m with a base width of 2,750 m. The artificial lake has a storingcapability of 179 Mca, as it is impounded from two major rivers Karaduwa and Gada (Sadauki*et al.*, 2022a). The impoundment was created mainly for the providing of domestic water supply with irrigation and fisheries improvement as a most important additional assistance.

2.1.1 Sample Collection, Identification and Sexing of ExperimentalFish

For period of (6) months, Thefish samples were collected from the selected study areas for a period of six months. The fish samples were transported alive to the Fisheries and Aquaculture laboratory of the Federal University Dutsin-Ma, Katsina State, in a plastic vessel filled with water for identification and examination.The fish were identified by Suleiman pictorial chart (2016) anddescription guide of Teugels*et al*. ~~description guide~~ (1998).The urogenital papillae

were examined by physical observation ~~of sampled fish. T~~ and the obesity of the testes in male and ovaries in the female was confirmed (Imam and Dewu 2010, Sadauki*et al.*, 2022).

2.1.2 Morphometric Determination of Experimental Fish

Standard morphometric measurements of body weight were ~~measured~~ recorded with a top loading sensitive weighing balance (GT4100 model) and the total and standard lengths of sampled fish were measured using meter rule (Sadauki*et al.*, 2022).

2.1.3 Examination of Experimental Fish Samples for Ectoparasites

~~Investigation of t~~The skin, fins and gills were examined for exposure of parasitic appearances~~asdone~~using hand lens~~ for exposure of parasitic appearances~~. Gills were successively~~cut out~~removed and ~~inserted into~~placed in ~~isolated~~ individual petri dishes and ~~detected~~ observed for parasite with a hand lens~~ for parasites identification~~. Parasites were ~~gathered~~collected and fixed in buffered formalin for additionaltreating and samplerecognition/identification using the method of Paperna (1991). The slime substance on the was taken with the help of ~~A~~a scalpel blade ~~was used to get the slime substance on the skin of *Clarias gariepinus*, and skin~~ smear was prepared~~made~~.~~The techniques were carried out using a spatula by which the membranerubbings (smears) from beginning of the head to the tail wasgotten, slime mixed with epidermal cells. Subsequently, the rubbed samples of slimecollected with the tissues was inserted on a Petri dish containing 3mls of 0.9% saline solution and agitated using a mounted pin (Bichi and Ibrahim, 2009;Sadauki *et al.*, 2022), followed by the adding of 1ml of saline solution for investigation using hand lens.~~Redraft the sentence.

2.1.4 Examination of Experimental Samples for Endoparasites

Investigation of the gastro-intestinal tract specifically the stomach and intestine were carried out. The individual fish samples were cut apart to expose the gastrointestinal tract. The gastrointestinal tract was cut offand split into two parts containing~~of the~~ intestine and stomach. ~~The gastrointestinal tracts were used for parasitic investigationsince this is where nourishment is most plentiful for the parasites fauna~~. Every singlesegment was inserted~~individuallyplaced~~in petri dishes containing 0.9% normal saline (Paperna, 1991). Every singlesegment was

cutlongitudinally and ~~looks at~~observed under dissecting light microscope in 10X and 30X magnification ~~for parasites below a dissecting light microscope between x 10 and x 30 magnifications~~ (Paperna, 1991). The appearance of ~~every~~worm was~~simplyseen~~assessed through its wriggling physical motion in the saline solution~~below a light microscope~~. Parasitic fauna~~discoveredwere count up~~obsereved were counted and preserved in ~~, and after that inserted andconserved~~in 5% formalin. The ~~A~~ typical parasite ~~was~~werestainedovernight using weaksolution of Erlich'shaematoxylin (Paperna, 1991;Bichi and Ibrahim, 2009;Sadauki*et al*., 2022).

2.1.5 Parasites Identification

The parasitic fauna ~~were~~ was identified ~~to a~~up to species level morphologically using the standard identification guides (Paperna, 1980;Moravec, F. 2006) and with standard keys in texts (Paperna, 1996, Roberts, 2001).

2.1.6 Parasite Prevalence and Intensity Estimation

The occurrence/prevalence of parasitic~~tes~~ infestation was calculated for sex, location,length and weight using the model described by Amos et al. (2018):

$$\text{Prevalence (\%)} = \frac{\text{No of fish host infected}}{\text{Total number}\sout{\text{no.}}\text{ of fish host Examined}} \times 100$$

$$\text{Percentage (\%) of infection} = \frac{\text{Number of a specific parasite in the samples}}{\text{Total number of parasite in the samples}} x100$$

2.1.7 Data analysis

Occurrence and intensity of infestation wasexpressedin percentage (%).Data were presented using descriptive statistics; a simple percentage was used to present the prevalence and distributions of parasites. The descriptive statistics was used to examine the association between infection and the risk parameters for the prevalence.

3. RESULTS

~~A~~ One hundred and eighty (180) pieces of wild African catfish *C. gariepinus* from Ajwa and Zobe reservoirs were examined for ec~~x~~to and endo parasites. No parasite was found in the gill and skin.Ninety ~~(90)~~ individual fish samples were collected and examined inAjiwa reservoir of

which. Out of the ninety fish samples, 40 were males and 50 were females.Female fish tended to have a highest number of infections 29 (58.0 %) while the male fish recorded 20 (50.0 %) as presented in (table 1). However tThe result was not significantly different between the fish sexes P<0.05. Ninety (90) individual fish samples were collected and look atfrom Zobe reservoir of which . Out of ninety fish samples from Zobe 47 were male and 43 were female.Male samples (fish) tended to have a highest number of infections 22(46.80 %) while the female fish recorded 20 (46.52 %) (Table 1).Data analysis displayedthat the resultthe results were was not significantly different among the sex of fishsexual category (Table 1). *Clarias gariepinus* samples obtained from Ajiwa reservoir, the parasite that had the higherincidencewereof *Monobothrium sp*. 26(36.12%).A number of the disease riddendiseased fishes have double infestation and as much as overall of 72 fully developed worms and, larvae lin addition to eggs waswerediscoveredrecordedin fishes examined, out of which 72 *Capilaria sp.* 16(22.23%), *Astiotrema sp.* 12(16.66%) *Larva Miracidium* 10(13.88%) *Ascaris eggs* 6(8.34%) and followed by *Metacercariae sp.* 2(2.77%) as the least parasitic infection. tThey were cestodes, digeneans and nematodes respectively (Table 2).Samples of African catfish *Clariasgariepinus*gotten incollected fromZobe artificial lake, the parasitic worms that had the higher numberincidence were*Monobothrium sp.* 21(24.42%).Some of the infested fishes hadve double infestation and a total of 86 fully developed worms, larval in addition to eggs were discoveredfoundin fishes examined, out of Which 86 *Ascaris eggs* 20(23.26%), *Capilaria sp.* 14(16.28),*Metacercariae sp.* 8(9.31%),*Camallanus sp*. 8(9.31%) *Pleurocercoid*or*Coradium* 5(5.82), *Astiotrema sp.* 5(5.82), *Larva Miracidium* 3(3.48) and followed by *Ascaridods*or *Anisakis*2(2.33%) as the least parasitic infection. they were cestodes, digeneans and nematodes respectively (Table 2)The samples of African catfish *Clariasgariepinus* gotten inAjiwaartificial lake. The stomach was the most infested 39(54.16%) of all the organs investigated, followed by the intestine with 33(45.86%). No parasite was found in the gills and skin (Table 3).The samples African catfish*Clarias gariepinus*found in Zobe artificial lake. The intestine was the most infected 51(59.3%) of all the organs investigated, followed by the intestine with 35(40.69%). No parasite was found in the gills and skin (Table 3).Out of the 90 fish samples collected from three (3) sample sites from Ajiwa and inspected, an totaloccurrence of 49(54.45%) weredocumented (Table 4). While there was no significant difference (P>0.05) in occurrence among fish from the various sample locations, catfish *Clariasgariepinus* obtained from Kadaji 17(56.66%) and

Gajerargiwa 17(56.66%) (Harboured) had the highest percentage of infection, while Kunduwaje sample location had the least percentage 15(15.00%).Statistical analysis showed that the result was not significant.Out of the 90 fish collected from 3 sample location from Zobe and examined, an overall prevalence of 42(44.66%) was recorded (Table 4). Although there was no significant difference (P>0.05) in prevalence among fish from the various sample location, catfish *Clariasgariepinus* obtained from Tabobi 18(60.00%) (harboured) had the highest percentage of infection, followed by Raddawa 14(46.66%), while Makera sample location had the least percentage 10(33.33%).Statistical analysis showed that the result was not significant. Table 5: Fish samples gotten inAjiwashowed that catfish within the length of 10.0-15.0cm give refuge to more parasites 33(67.34%) followed by 15.1-20.0cm 7(43.75%), 20.1-25.0cm 7(41.17%) while individuals within the length of 25.1-30.0cm had smaller worm load 2(25.0%). Fish samples found from Zobe indicated that catfish within the length of 20.1-25.0cm shelteredadditional worms 15(83.34%) followed by 10.0-15.0cm 14(40.0%), 15.1.20.0cm followed by 12(37.50%) whereasindividualssample within the length of 25.1-30.0cm had smaller parasiticload 1(20.0%)(Table 5).

Table 1:**Prevalence of parasites of *Clarias gariepinus* in relation to sex fromAjiwa and Zobe reservoirs**

Sex	**Ajiwa Reservoir**			**Zobe Reservoir**		
	Number Examined	**Number Infected**	**Prevalence (%)**	**Number Examined**	**Number Infected**	**Prevalence (%)**
Male	40	20	50	47	22	46.80
Female	50	29	58	43	20	46.52
Total	**90**	**49**	**54**	**90**	**42**	**46.66**

Table 2:Prevalence of parasites of *Clariasgariepinus* in Ajiwa and Zobe reservoir

Ajiwa Reservoir			**Zobe Reservoir**		
Name of parasite	**Taxonomic Group**	**Number Isolated**	**Name of parasite**	**Taxonomic Group**	**Number Isolated**
Monobothrium sp.	Cestode	26	*Monobothrium sp.*	Cestode	21

Capilaria sp.	Nematode	16	*Capilaria sp.*	Nematode	14
Larva miracidium	Digenea	10	*Larva Miracidium*	Digenea	3
Metacercariae sp.	Digenea	23	*Metacercariae sp.*	Digenea	8
Astiotrema sp.	Digenea	12	*Astiotrema sp.*	Digenea	5
Ascaris sp.	Nematode	6	*Ascaris sp.*	Nematode	22
			Camallanus sp.	Cestode	8
			Pleurocercoid sp.	Cestode	5

Table 3: Prevalence of parasites of *Clarias gariepinus* in Zobe reservoir in relation to site ofinfestation

Name of Parasite	**Ajiwa Reservoir**				**Zobe Reservoir**			
	Ectoparasite (Prevalence)		**Endoparasite (Prevalence)**		**Ectoparasite (Prevalence)**		**Endoparasite (Prevalence)**	
	Skill	**Gills**	**Intestine**	**Stomach**	**Skin**	**Gills**	**Intestine**	**Stomach**
Monobothriumsp.	0	0	10(30.31)	16(41.02)	0	0	13(25.49)	8(22.85)
Capilaria sp.	0	0	10(30.31)	6(15.38)	0	0	8(15.68)	6(17.15)
Larva miracidium	0	0	6(18.18)	4(10.26)	0	0	1(1.96)	2(5.71)
Astiotrema sp.	0	0	4(12.13)	8(20.52)	0	0	2(3.92)	3(8.57)
Ascaris sp.	0	0	2(6.06)	4(10.26)	0	0	4(7.84)	3(8.57)
Metacercariae sp.	0	0	1(3.04)	1(2.56)	0	0	2(3.92)	3(8.57)
Pleurocercoid					0	0	17(33.34)	3(8.57)
Camallanus sp.					0	0	3(5.88)	5(14.28)

TABLE 4: Prevalence of parasites of *Clarias gariepinus* in relation to sample location inAjiwaand ZobeReservoirs

	Ajiwa Reservoir	**Zobe Reservoir**

Sampling Location	No. Examined	No. Infected	% of Infection	No. Examined	No. Infected	% of Infection
Station A	30	17	56.66	30	14	46.67
Station B	30	15	50.00	30	18	60.00
Station C	30	17	56.66	30	10	33.33
Total	**90**	**49**	**50.44**	**90**	**42**	**46.67**

TABLE 5: Prevalence of parasites of *Clarias gariepinus* in relation to length in Ajiwaand Zobe Reservoirs

	Ajiwa Reservoir			**Zobe Reservoir**		
Sampling Location	No. Examined	No. Infected	% of Infection	No. Examined	No. Infected	% of Infection
10.0 – 15.0	49	33	67.35	35	14	40.00
15.1 – 20.0	16	7	43.75	32	12	37.50
20.1 – 25.0	17	7	41.18	18	15	83.33
25.1 – 30.0	8	4	50.00	5	1	20.00
Total	**90**	**49**	**54.44**	**90**	**42**	**46.67**

4. Discussion

Abiotic influences, such as increased water temperature, can alter the state of resistancesituation in fish facilitating infestation and set up of parasitic worms (Onyishi and Aguzie, 2018).Akinsanya and Otubanjo (2006) preached that geo-climatic variances might be an important factor ininfluential/determining, not just theoccurrence of parasites infreshwaterbodies such as rivers and dams, but also the parasite populations found in freshwater fishes such as *T. zilli* and *C. gariepinus*. Data has displayedthat parasitic worms are regularlydiscoveredin entirely aquatic fishes such as *T. zilli and C. gariepinus*, with their incidencein additionstrengthdependent on the parasiticfaunaalso their ecology, host and its nourishingbehaviours, physical factors in additionsanitation of the aquatic environment thenmanifestation of middle hosts where needed (Hussen et al., 2012).From current survey, six types of parasitic worms inAjiwa reservoir and nine types of parasitic fauna in Zobe reservoir

from three Classes were identified.Related outcomes were identified by Kawe et al. (2016) from African catfish*Clarias gariepinus* from dissimilar Association zones from F.C.T, Abuja, Nigeria. Kawe et al. stated2 (two)types of Nematode representative approximately 56% of the infestation, a classes of Cestode and two species of Trematode. Dan-Kishiya and Zakari (2007) similarly identified Nematode, Cestode and Trematode from wild *C. gariepinus* in Gwagwalada Abuja, However Salawu *et al.* (2013) identified Nematode Cestode from the digestive tracts of *C. gariepinus* from Ogun River and Asejire Dam in South-west, Nigeria. Abdel-Gaber et al., (2015) and Khan, (2012) likewise identified related outcomes. On the other hand, Amos et al. stated (2018) extreme highest in relations of total number, species and Classes. Nine Classes, 16 species and 396 separate parasitic worms was identified in 60 matured fish and 60 juveniles of *C. gariepinus* in Lake Gerico, Yola, Adamawa State. No parasite were recovered in the gills and skin of *C. gariepinus* obtained inAjiwa and Zobe reservoirs dissimilar in the direction of our research, Amos et al. (2018) identified the parasitic worms in the gill, skin, and gastrointestinal tract of sampled fish.Parasitic occurrence, the moderately highest infestation rate from most females than that of males in Ajiwa reservoirthe study is related to the discoveries of Ratnabir et al. (2015) and Amos et al. (2018) who stated that female fish samples anchorageadditional parasites associatedmale fish samplesbut disagrees with the discovery of Ugbor et al. (2014) who identified additional parasite infection from males fish samples than from female fish samples. While parasitic incidence, the moderately higher infection rate in most males than that of females in Zobe reservoir this research is disagree with the results of Ratnabir et al. (2015) and Amos et al. (2018) who stated that female fish samples anchorageextra parasitic wormsassociated male fish samplesbut agrees with the outcome of Ugbor et al. (2014) who indicated more parasite infection in males than in the female.However, the female sex documented higher infestation which may possibly be due to differencenutritiveboth by amount or excellence of nourishment consumed and as anoutcome of dissimilaramounts of struggle/fight to infestation (Ogonna et al., 2017).The presentinvestigationdisplayed that, the higherdegree of parasites invasion in diverse fishes was noted in lesser fishes. The likelypurpose for this may possibly be that lesser fishes nourished on a smaller amount of nourishmenthenceforth gained a smaller amount ofprotectionrelated to the bigger fishes. This is in conformitywith Shehata et al. (2018) who stated that lesser fish wasadditionaldisease-riddenrelated to biggerfishes maybe due to their nature of acquired resistance/protection with oldness. In dissimilarity, the current surveydiffers

with discoveries of Ashade et al. (2013) who stated that maturedthen therefore maybe adult fish have extra parasites associated to lesser fish since they nourishadditional on dissimilarnourishment sources sorevealing them to additional parasite worm'sinvasion.

5. CONCLUSIONS

The current survey in Ajiwa and Zobe reservoirs display a low to average occurrence of gastro-internal parasitic invasions and shown three classes of parasitic fauna existing in fish.The discoveries of this survey are predictable to help as reference line parasitic data for upcoming research to safeguard and improve the environmental potential of Ajiwa and Zobe reservoirs.Actions that have the possible of growing the richness of parasitic wormsmay perhaps be controlled by necessary managementorganizations that are in control for the supervision of the aquatic water body.With rise in fish farming, it is also vital/needed to have amenities/equipment's for examination and treatment of fish sicknessesmostly in the research areas.

RECOMMENDATION

This study recommends that appropriatefood preparation of fish andconsumption of correctlyroasted fish serve as precautionarymeasures to possible zoonotic parasiteinfestation.A number of the parasitic wormsdetectedparticularly the cestode parasites identified are zoonotic skilful of causingseverecommunityhealthiness infestation in human being, consequently, the aforementioned is suggested that the intestine and stomachregion of *Clariasgariepinus*collectedin Ajiwa andZobe reservoirshave to be thrown away before the fish is eaten.There is need forfurther researches on the status of contamination; highlighting the presentphysicochemical parameters conditions water of Ajiwa and ZobeReservoirs, to find out the exact correlation between contamination, toxic waste and parasitism in the reservoirs.

In addition, study similarly recommends additional survey on lifespan of most important parasitic wormsdetected such as digeans, cestode and nematodes, should be carry out in direction to develop the proceduressuitable to stop and governparasitic woems.

REFERENCES

Abdel-Gaber, R. El Garhy, M. Morsy, K..Prevalence and Intensity of Helminth Parasites of African Catfish Clariasgariepinus in Lake Manzala, Egypt. Advances in Bioscience and Biotechnology 6, 464-469. Published Online July 2015 in SciRes. http://www.scirp.org/journal/abb http://dx.doi.org/10.4236/abb.2015.67048.

Ahmad, I., Afshan, K., Ramzan, M., Hayat, S.,Rizvi, S. S. R. and Qayyum, M.Effect of Water Quality Parameters onIsopod Parasite Alitropustypus (Aegidae)of Ectotherms in ChashmaLake,Pakistan. Pakistan Journal of Zoology,2016;48(3): 769-779.

Akinsanya B, Otubanjo OA. HelminthParasitesofClariasgariepinus (Clariidae) in LekkiLagoon, Lagos, Nigeria. Revista deBiologiaTropical 2006;54(1): 93-99

Amos, S. O., Eyiseh, T. E. and Michael E. T. Parasiticinfection and prevalence in Clariasgariepinus in Lake Gerio,Yola, Adamawa state. MOJ Anat Physiol.; 2018;5(6): 376-381.DOI: 10.15406/mojap.2018.05.00229

Ashade, O. O., Osineye, O. M., Kumoye, E. A.Isolation, identification, and prevalence of parasites onOreochromisniloticus from three selected River Systems. J.Fish Aquatic Sci.,2013; 1: 115 - 121.

Bichi, A. H. and Ibrahim, A.A.A survey of ecto and intestinal parasite of Tilapia zilli (Gervais) in Tiga Lake, Kano, Northen Nigeria. Bayero Journal of Pure and Applied Science, 2009;2(1), 79-82.

Dan-kishiya, A.S. and Zakari, M. Study on the gastrointestinal helminth parasites of Clariasgariepinus (Tuegels) in Gwagwalada, FCT, Nigeria. BEST Journal. 4(2): 79-81.

Edema, C. U., Okaka, C. E., Oboh, I. P. and Okogub, B. O.A preliminary study of parasiticinfections of some fishes from Okhuo River, Benin city, Nigeria. International Journal of Biomedicaland Health Sciences, 2008;4(3):107 -108.

Hussen, A., Tefera, M. and Astrate, S. Gastrointestinal helminth parasites of Clariasgariepinus (catfish) in Lake Hawassa, Ethiopia. Scientific Journal of Animal Science 2012;1(4):131 – 136.

Imam, T. S. and Dewu, R. A.Survey of Piscine ecto and intestinal parasites of *Clariassp.*sold at Galadima road fish market, Kano metropolis, Nigeria.*Bioscience Research Communication*, 2010;**22**(4):209.

Ito E,E.Survey of parasites of two fish species (Tilapia zillii and Clariasgariepinus) in Ase River Catchment,Delta State, Nigeriahttps://doi.org/10.12980/jclm.5.2017;J7-126 ©2017 by the Journal of Coastal Life Medicine. All rights reserved.

Kawe, S.M. God'spower, R.O. Balarabe, M.R. and Akaniru R.I. Prevalence of gastrointestinal helminth parasites of Clarias gariepinus in Abuja, Nigeria. Sokoto Journal of Veterinary Sciences 2016;14(2), 26-33.

Moravec, F. Reconstruction of the genus *Rhabdochonarailliet*, 1916 107 with a review of the species parasitic in fishes of Europe and Asia. Studies CSAV, Prague 2006; (8), 104.

MSG,.Parasites Kill Fish. Minnesota Sea Grant (MSG) www.seagrant.umn.edu /fisheries/parasites Accessed 18 February 2017.

Ogonna, C. A. Emmanuel, I. N. and Cynthia, E. Prevalence of Intestinal Parasites of Fish Farmed and Harvested in Abakiliki, Nigeria: A Pointer to the Level of their Vulnerability. International Journal of Research in Pharmacy and Biosciences 2017;4, 7-10.

Onyishi, G. C. and Aguzie I. O. N. Survey Of Helminth Parasites Of Fish In Ebonyi River At Ehaamufu, Enugu State, Nigeria. Animal Research International 2018;15(3), 3112 – 3119

Paperna, I. Diseases caused by parasites in the aquaculture of warm water fish. Annual Review of Fish Diseases, 1991;1, 155-194.

Paperna, I. Parasite, Infections and Disease of Fishes in Africa- An update.*CIFA Technical paper* 31, pp. 1996;1-220.

Paperna, I. Parasites, Infections and Diseases of Fishes in Africa. CIFA Tech. paper 7. FAO OF THE UN, Rome, Italy.1980 216p.

Ratnabir, S., Shomorendra, M. and Kar, D. Parasite infection of three freshwater fishes in DoluLake, Silchar, Assam. International Journal of Fisheries and Aquatic Studies, 2015;2(3): 125-127.

Roberts, R.J. *Fish Pathology*.3rd edn. Technical Director, Landa catches Ltd. Scotland, pp. 2001; 270–300.

Sadauki, M. A., Bawa, S. B, and J, Umaru.Studies on parasitic infestation and prevalence in Clarias gariepinus (Burchell, 1822) from Zobe reservoir, Katsina State, NigeriaNigerian J. Anim. Sci. 2022b, 24 (1): 100-107

Sadauki, M. A., Bawa, S. B, and Nababa, A. S.Gastro-intestinal helminth fauna of clariasgariepinus (burchell, 1822) in Jibia reservoir, Katsina state, Nigeria FUDMA Journal of Sciences (FJS)ISSN online: 2616-1370ISSN print: 2645 - 2944Vol. 6 No. 1, March, 2022a, pp 107 - 111DOI: https://doi.org/10.33003/fjs-2022-0601-883

Sadauki, M.A., Bichi, A.H., Dauda, A.B.andGeidam, M.B.Assessment of Water Quality Parameters of Zobe and Ajiwa Reservoirs, Katsina State, Nigeria.African Scientist Vol. 23, No. 1 March 31, 2022 1595-6881/2021 $10.00 + 0.00Printed in Nigeria © 2022a Society for Experimental Biology of Nigeriahttp://www.niseb.org/afs

Salawu, M.T., Morenikeji, O.A., Sowunmi, A.A. and Odaibo, A.B. Comparative survey of helminth parasites of Clariasgariepinus and Clariaspachynema from the Ogun River and Asejire Dam in southwestNigeria, International Journal of Fisheries and Aquaculture, 5(1): 2013;7-11.

Shafi, N. Ayub, J.andAkhtar, T. (2015).Physico -Chemical Variables and Fish Parasites of River Neelum Azad Jammu and Kashmir, Pakistan. Journal of Bioresource Management 2(2), 73-80.

Shehata, S. M., Mohammed, R. A., Ghanem, M. H.,Abdelhadi, Y. M. and Radwan, M. K. Impact of the stresses environmental condition on the prevalence of parasite in freshwater aquaculture. Journal of Fisheries Sciences. EISSN 2018;1307-234X.www.fisheriessciences.com

Suleiman, B. Catalogue of Fishes of Kaduna River, Kaduna, Nigeria, 19pp. ISBN: 2016; 978 978 53916 5 7

Teugels, G. G., Legendre, M. and Hung, L. T.,. Preliminary results of the morphological characterization of natural population and culture strains of Clarias species (Suliriformes, Clariidae) from Vietam. In: Legendre and AntonieParisselle (Eds). The biological diversity and aquaculture of clariid and pangasiid catfishes in South- East Asia. Proceedings of the mid-term worksho of the "catfish Asian Project". 27-30, (1998).