EPH - International Journal of Applied Science
ISSN (Online): 2208-2182
Volume 02 Issue 01 March 2016

DOI: https://doi.org/10.53555/eijas.v2i1.35

PREVALENCE OF ECTOPROTOZOAN PARASITES INFECTING MUGIL CEPHALUS (LINNAEUS, 1758) AND TILAPIA ZILLII (GERVAIS, 1852) FROM AIN ZIANA LAGOON, BENGHAZI, LIBYA.

Hamed H. Kassem[1]*, Nada M. Abd-Al-Salam[1], Salem M. Bowashia[2] and Faisal F. Mohammad [3]
*[*1] Departments of Zoology, Faculties of Science, Benghazi University,*
[2] Omar Al-mukhtar University and
[3] El-Marej branch, Libya.

Corresponding author:-
E-mail: *Hamed.HK2017@yahoo.com*

Abstract:-
This study was carried out to detect prevalence of external parasites affecting marine water fishes. Two hundred and twenty-four tilapia and mullet (Mugil cephalus and Tilapia zillii) fishes were collected from AinZiana lagoon, during the period from October 2009 to December 2010. The results showed that the overall prevalence of the ectoprotozoan parasites was 22.3%, prevalence rate in Tilapia zillii was 15.8%, while in M. cephalus was 29.8%.The isolated ectoparasites among examined fishes were Myxobolus sp., Ichthyophthirius multifiliis, Chilodonella sp., Trichodina sp., Tetrahymena sp. And Ichthyobodo necator at prevalence rates 13.80%, 6.5%, 4.5%, 1.3% and 0.9% respectively. It was noted that there are sixteen (84.21%) of T. zillii, and twenty one (67.74%) of M. Cephalus had single infections of ectoprotozoan parasite, and three (15.79%) of T. zillii and ten (32.26%) of M.
Cephalous had mixed infections.

Key words:-*External protozoan parsites, Mugil cephalus, Tilapia zillii, Benghazi, Libya.*

INTRODUCTION

Fish is one of our most valuable sources of protein food.All over the world, fishes are one of the main sources of protein supply to human, as it can serve to solve the malnutrition and deficiency of proteins in the world. The economic importance of fishes were represented in the food resources for many countries, fishes have a major value for humans either to provide them with proteins or by acting as a definitive or intermediate hosts for several parasites and diseases which may infect fishes and human or other animals (1). The study of *Mugil cephalus* and *Tilapia zillii* is of a great importance in fisheries, especially in terms of commercial and aquaculture, the commonest fishes in fish markets of Benghazi. These fishes are characterized with its good quality of taste and cheap price.

They are found in large number in the coastal seawaters of Benghazi and AinZiana lagoon. Ecto-parasites are the most dangerous group that causes severe mortalities (2). Fishes in nature are infected with a great variety of protozoan parasites, diseases resulting from these infections have not been reported very often, for several possible reasons such as certain Stages of the parasites may be dispersed in a large volume of water and therefore fish are not heavily parasitized and parasites may do little harm or the most severely affected fish die. Many fish disasters, both in open water and fish farms were caused by different ectoparasitic protozoa parasites, which have direct life cycle and facilitate translocation from host to host making huge damages to fish health.Parasitic protozoa infecting fishes may be found in all body tissues, but they are particularly common on the skin and gills (3). Many reports from all over the world indicated great losses in fish culture caused by protozoan parasites. Obligate parasites such as the ciliate *Ichthyophthirius*and certain speciesof the cnidosporidians are responsible for many of these losses. Many species, which are considered as commensally protozoans, may become pathogenic under certain conditions.(4 and 5). Main harm or protozoan parasites to the fish host are mechanical damage, secretion of toxic substance, occlusion of the blood vessels obtaining nutrition at the expense of the fish host, and rendering the host more susceptible to secondary infections. Some of the most common clinical signs are changes in swimming habits, such as loss of equilibrium, flushing or scraping, loss of appetite, abnormal coloration, tissue erosion, excess mucous production, hemorrhage and swollen body or distended eyes (6). They can easily spread among most of the fish hosts. Uncontrollable or recurrent infection with ciliated protozoans is indicative of unhygienic husbandry problems (7).

METHODS AND METHODS

Study area: AinZiana lagoon is a brackish body of water lies about 15 Km east of Benghazi city center (Located at 23°12′55.12″ N 20°09′ 15.23″ E). Its open water surface covers about 50 ha. In addition, there are large adjoining marsh areas on the south eastern and north western sides that total several hundred hectares in extent. Numerous underground springs charge the lagoon with freshwater, but there are also saltwater incursions from the sea. The open water area of AinZiana lagoon is host for a small mullet, eel and bream fishery .This study was carried out during the period from October 2008 to December 2009. So far no study on ectoprotozoan parasites was done on fishes in Libya (Fig. 1).

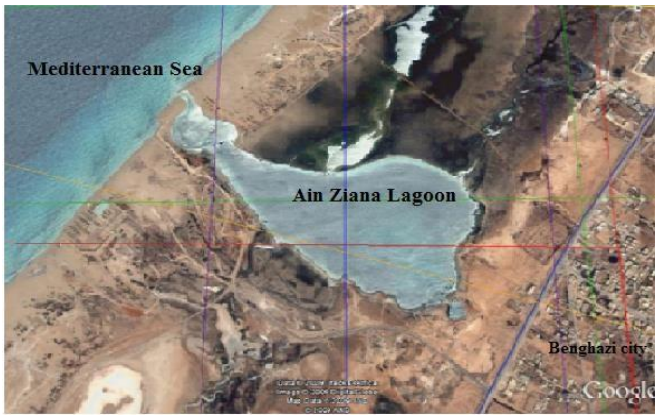

Figure (1): AinZiana lagoon

Fish samples: A total number of 224 (104 *Mugil cephalus* and120 *Tilapia zillii)* fish were collected alive from AinZiana lagoon and then transported alive to the laboratory of Zoology Department Faculty of Science, Benghazi University where they examined immediately.

Parasitological examination: Parasitological examination was carried out for the detection and identification of the external protozoan parasites on the skin, gills and the accessory respiratory organs of the samples.

Collection and preparation of the detected ectoparasites: Some of the positive slides were stained according to Klein's dry silver impregnation method in which the slides were air –dried, covered with 2% aqueous solution of silver nitrate (AgNO3) for 8 minutes, rinse thoroughly in distilled water and exposed to UV light for 20-30 minutes or to direct sun light for 1-2 hr. The slides were allowed to dry and mount with neutral Canada balsam. This method is indispensable technique for staining *Trichodina* (8) and (9). Other positive slides were also air-dried, fixed with absolute methanol and stained with 10% Giemsa stain for 20-30 minutes to detect the other protozoa (10).

RESULTS

Incidence: Fifty (22.3%) out of two hundred twenty four collected *Mugil cephalus* and *Tilapia zillii* were found infected with ectoprotozoan parasites. The result revealed that thirty one (29.8%) of *M. cephalus* were infected with ectoprotozoan parasites, while in case of *T .zillii* only nineteen (15.8%) were infected (Table 1).

Table (1): Overall incidence of ectoprotozoan parasitic infection in examined fishes.

Type of fishes	No. examined	No. infected	Percent (%)
M. cephalus	104	31	29.80%
T. zillii	120	19	15.8%

Six species of ectoprotozoan parasites of *M. cephalus* and *T. zillii* were detected during the examination of skin and gills contents of these fishes. Theses parasites were *Trichodina* sp., *Tetrahymena* sp., *Chilodonella* sp., *Myxobolus* sp., *Ichthyophthirius multifiliis*, *Ichthyobodo necator*. The result showed that, the most common protozoan parasite with highest infection rate was *Myxobolus* sp. 13.8% (31/224) followed by *Ichthyophthirius multifiliis* 6.5% (15/224) *Chilodonella* sp., 4.5% (10/224), *Trichodina* sp. 2.7% (6/224), *Tetrahymena* sp.1.3% (3/224) and *Ichthyobodo necator* 0.9% (2/224) (Table2).

Myxobolus sp.: was the most common protozoan parasite recovered from the skin and gills of Mugil *cephalus* 12.1% (27/224) and *Tilapia zillii* 1.8% (4/224) samples from the study area. Overall incidence of *Myxobolus* sp. was (13.8%) three species recovered from the gills, and one species was recovered from the skin, and one species recovered from both gills and skin (Fig. 2A).

Ichthyophthirius multifiliis: This species was isolated from of the skin of *M. cephalus* and *T. zillii* fishes. The overall incidence rate was 6.7% (15/224). The incidence rate for each fish species was 8.6% (9/104) in examined M. *cephalus* and 5% (6/120 in *examined Zillii*) (Fig. 2B)

Chilodonella sp.: This species was recovered from the skin of both *M. cephalus* and *T. zillii* fishes. The overall incidence rate was 4.4% (10/224). The incidence rate for each species was 1.9% (2/104) in examined *M. cephalus* and 6.6% (8/120) in examined *T. Zillii*. (Fig. 2C)

Tetrahymenina sp.: This species was isolated from the skin of *T. zillii* fish. No *Tetrahymena* was recovered from *M. cephalus*. The overall incidence rate was 1.3% (3/224) (Fig. 2D).

Trichodina sp.: was isolated from the gills of *M. cephalus* fishes. No *Trichodina* was detected in *T. zillii*. The incidence rate was 12% (6/224) (Fig. 2E).

Ichthyobodo necator: *I. necator* was isolated from the skin. Very fast randomly spiral motion. Flat, oval body, it's strongly convex dorsally and slightly concave ventrally, two unequal flagella extend from flagellar pocket, an oval. Centrally located nucleus, measured about 7.6µm (6.1-9.1µm)in length and 4.1µm (2.0-6.2µm) in width (Fig. 2F).

Table (2): Overall incidence of ectoprotozoan parasitic species in examined fishes.

Type of parasites	*M. cephalus* (N=104)		*T. zillii* (N=120)		Total (N=224)	
	No. infected	(%)	No. infected	(%)	No. infected	(%)
***Myxobolus* sp.**	27	26.0%	4	3.33%	31	13.84%
Ichthyophthirius multifiliis	9	8.65%	6	5.0%	15	6.70%
***Chilodonella* sp.**	2	1.90%	8	6.67%	10	4.46%
***Tetrahymena* sp.**	0	0.00%	3	2.50%	3	1.33%
***Trichodina* sp.**	6	5.76%	0	0.00%	6	2.68%
Ichthyobodo necator	0	0.00%	2	1.67%	2	0.89%

Incidence and sex: Infection of ectoprotozoan parasite was detected in both males and females of *M. cephalus* and *T. zillii*. The relationship between prevalence of ectoparasitic protozoan parasites and sex is presented in Table (3). Out of the total *M. cephalus* males constituted 22 (24.4%) and female 4 (28.6%), and *T. zillii* males constituted 16 (21.3%) and female 3 (6.70%). There was significant difference was detected between incidence and sex (P=0.000*) in both fish species.

Table (3): Relationship between ectoprotozoan parasitic infections among examined fish and sex.

Fish types	Sex			
	Males		Females	
	No. Examined	No. infected	No. Examined	No. Infected
M. cephalus	90	22 (24.44%)	14	4 (28.57%)
T. zillii.	75	16 (21.33%)	45	3 (6.67%)
Total	165	38 (23.03%)	59	7 (11.86%)

Prevalence and seasons: The prevalence of ectoprotozoan parasites of *T. zillii* was higher in autumn (77.3%) rather than *M. cephalus* was (43.8%), but *M. cephalus* was higher in winter (42.9%) rather than *T. zillii* was (28.6%). In summer infection in *M. cephalus* was (13.8%) but no infection was detected in *T. zillii.* (P=0.001) (Table 4).

Table (4): Relationship between infection ectoprotozoan parasites of examined fish and season.

Fish Type	Seasons					
	Winter		Summer		Autumn	
	No. Exam.	No .infected	No. Exam.	No .infected	No. exam.	No. infected
M. cephalus	7	3 (42.86%)	65	9 (13.85%)	32	14 (43.75%)
T. zillii	7	2 (28.57%)	91	0 (0.0%)	22	17 (77.27%)
Total	14	5 (35.71%)	156	9(5.77%)	54	31 (57.41%)

Incidence and body length: The prevalence of infection with ectoprotozoan parasite on skin and body length of *M. Cephalus* and *T. zillii* presented in Table (5). Significant difference between incidence and body length was detected (P=0.000).

Table (5): Relationship between infection ectoprotozoan parasites of examined fish and body length.

Fish type	Body length (cm)							
	5 - 14.9		15 - 24.9		25 - 34.9		35 - 44.9	
	No. Exam.	No. infected	No. Exam.	No . infected	No. Exam.	No. infected	No. Exam.	No .infected
M. cephalus	28	7 (25%)	72	17(24.0%)	4	2(50%)	0	0 (0.00%)
T. zillii	101	16 (15.84%)	16	2(13.0%)	0 (0.00%)	0(0.00%)	3	(33.33%)1

Single and mixed of infection on skin: Twenty one (67.74%) of infected *M. cephalus* had single infection (with one species of parasites) and ten (32.26%) had mixed infection (infected with more than one species of parasites). While sixteen (84.21%) of *T. zillii*had single infection and three (15.79%) had mixed infection. The result showed that there was a significant differences were detected between incidence and type of infection (p =0.008) (Table 6).

Table (6): Single and mixed infection of ectoprotozoan parasites on skin of infected fishes.

Types of infection	Fish type	
	M. cephalus (n=31)	*T. zillii* (n=19)
Single infection	21 (67.74 %)	16 (84.21%)
Mixed infection	10 (32.26%)	3 (15.79%)

DISCUSSION

The present study revealed that the prevalence rate of ectoprotozoan parasites was 22.3% in examined fishes. Such prevalence lower than those reported by other authors (11"51% "; 12"61.3%"; 13"34%" and 14"30 %"). However a higher than incidence reported by (15) (18.4%). Such variation in the obtained data could be due to fish health condition, affected by environmental, geographical distribution, water temperatures, type of water supply, crowding, transport, and management practices such as handling.(12; 16; 17; 15; 13 and 14). The present task reveled the infestation of *Mugil cephalus* and *Tilapia zillii* by six ectoprotozoan parasites. They are (*Trichodina sp., Tetrahymena sp., Chilodonella* sp., *Myxobolus* sp., *Ichthyophthirius multifiliis* and *Ichthyobodo necator*. The same parasitic species were recorded from different fishes (11; 12; 13; 15; 18; 19 and 20). The detected prevalence of *Myxobolus* sp. obtained in the present task was 13.8%. Such incidence was lower than those reported by other authors (21"48.05%" and 22"27.3 %"). However, a higher than incidence reported by (23) was (11.76%).

The detected prevalence of *I. multifiliis* was (6.7%). Such prevalence was higher than those reported by 13 “3.7%”. However such prevalence was lower than those reported by other authors (11"9.1%"; 24"9.1%"; 25"54.5%"; 26"100%"; 27"81% "and 28"21 %"), the prevalence of *Chilodonella* sp. obtained in the present task was (4.4%). Such incidence was higher than those reported by 13"0.5% ". However incidence was lower than those reported by other authors (29"20%" and 27"58 %"). The detected prevalence of *Trichodina* sp. Reveled in the present study was (3.1%), such prevalence was slightly lower than those reported by other authors (13"4.7%" and 30"5.3 %"). However prevalence was lower than those reported by other authors (11"26.1%"; 31"21.7%"; 32"49.6%"; 33"13.3%" and 22"95.5 %"). The detected prevalence of *Tetrahymena* sp. obtained in the present task was (1.3%), such prevalence was lower than those reported by other authors (25"7.2%" and 15"4.1 %"). The incidence rate of *I. necator* was (0.8%). Such incidence was lower than those reported by other (24"30%"; 12"15.2%"; 34, 2003"38%" and 15"1.7 %"). The prevalence of detected of ectoprotozoan parasites in examined fishes was significant high in male (24.3%) than females (11.8%). This agreed with (23). This was in accordance with (35) and (20). Such variation in the obtained data could be due to male are known to be usually more sensitive to parasites than females due to testosterone synthesis which may exert a cost, decreasing immune competency (36). Concerning seasonal detected the present task revealed that significant the incidence to the detected parasites higher in autumn (57.4%) followed by winter (35.7%) and lowest in summer (13.8%). This agreed with (35) and (37). Such variation in the obtained data could be due to combination of fluctuations in salinity, temperature and pH and geographical

distribution (38). With regard to effected of length, the present task revealed that these was a significant increase in incidence of the detected parasites with the increase in fish length. This was in accordance with (35) and (39). May increase infection with increases large body size fishes in the present study return to increase loaded ectoprotozoan with time.

The present study for examined fishes revealed that overall incidence on skin 2.5% and 13.3% of infection were mixed and single infection respectively. Single infection of ectoprotozoan parasite recorded in many studies (40); (23) and (30). Mixed infection on skin with, *I. multifiliis* and *Chilodonella* sp. (30), *I. multifiliis* and *Myxobolus* sp. (11), *Tetrahymena* sp. *I. multifiliis* and *Ichthyobodo necator* (15). Concerning incidence on *M. cephalus* gills was 9.6% and 9.6% of infection were mixed and single infection respectively. Mixed infection on with *Trichodina sp.* and *Myxobolus* sp. from *M. cephalus* (22).

REFERENCES

[1].Ahmed, A. M. (2010). Studies on Helminth parasites of Marine Fishes: Mullusser pentullus, Epinephele sguaza and Pargrus pargrus (Linnaeus, 1958) in coastal seawater of Sirt, Libya. Msc. Thesis, Sirt University.

[2].Shalaby, S. I. A. and Ibrahim, M. (1988). Parasitological and pathological studies on encysted metacercariae in the musculature and different organs of Tilapia nilotica. Egypt. J. Comp. Pathol. Clin. Pathol., 2 (1): 186-212.

[3].Areerat, S., Boonyaratpalin, S., Chinabut, S., Pawaputanon, K., MacRae, I. H., Muir, J. F., Richards, R. H., Roberts, R. J. and Summerville, C. (1981). Infectious diseases: (A handbook of diseases of cultured clarias (Pladuk) in Thailand. FAO. Thailand. 1st Ed.

[4].Williams, A. and Jones, N. (1976). Didymozoid trematode infection of snapper. Pagrusauratus (Sparidea) off Western Australia: parasite population biology and fishery implications. J. fisheries res., 16: 113-129.

[5].Williams, H. and Jones, A. (1994). Parasitic worms of fish. London. Taylor & Francis Ltd. 593.

[6].Yokokawa, T. (1982). Water quality for coastal aquaculture: Report of the Training course on sea bass spawning and larva rearing held at the national institute of Coastal Aquaculture. Japanese International Cooperation Agency, Manila. 1st Ed.

[7].AL-Rasheid, K. A., Ali, M. A., Sakran, T., Abdel-Baki, A. A. and Abdel-Ghaffar, F. A. (2002). Some species of the genus Myxobolus (Myxozoa: Myxosporea) infecting freshwater fish of the River Nile, Egypt, and the impact on their hosts. Parasitol Res. Jan., 88 (1): 9-15.

[8].Lom, J. and Dykova, I. (1992). Protozoan parasites of fishes. Elsevier Science Publisher, Amsterdam. 315pp.

[9].El-Tantawy, S. A. M. and El-Sherbiny, H. A. E. (2010). Some Protozoan Parasites Infecting Catfish Clariasgariepinus Inhabiting Nile Delta Water of the River Nile, Dakahlia Province, Egypt. J. Am. Sci., 6 (9): 676-696. R000yero Journal of Pure and Applied Sciences. 3(1): 104 – 107.

[10]. Alvarez D. E. (2008). Studies on Parasites of hardhead (Mylopharodo nconocephalus) and sacramentopikeminnow (Ptychocheilus grandis) from the north fork feather river, plum as and butte counties, California. M sc. Thesis, Humboldt State University.

[11]. Heckmann, R. and Farley, D. G. (1973). Ectoparasite of the western roach from two Foothill streams. J. Wildlife Diseases. 9:2 21-224.

[12]. Urawa, S. (1992). Host Range and Geographical Distribution of the Ectoparasitic Protozoans Ichthyobodo necator, Trichodina truttae and Chilodonella piscicola on Hatchery-Reared Salmonids. Scientific Reports of the Hokkaido SA Irnon Hatchery No.46: 175-203.

[13]. Piazza, R. S., Martins, M. L., Guiraldelli, L. and Yamashut, A. M. M. (2006). Parasitic Diseases of Freshwater Ornamental Fishes Commercialized in Florianopolis, Santa Catarina, Brazil. J. Brazilian Biol., 32 (1): 51-57.

[14]. Kayis, S., Ozcelep, T., Capkin, E. and Altinok, L. (2009). Protozoan and Metazoan Parasites of Cultured Fish in Turkey and their Applied Treatments. J. Aquaculture– Bamidgeh., 61 (2): 93-102.

[15]. Thilakaratne, I. D. S. I. P., Rajapaksha, G., Hewakopara, A., Rajapakse, R. P. V. J. and Faizal, A. C. M. (2003). Parasitic infections in freshwater ornamental fish in Sri Lanka. J. Dise. Aqua. Organ. 54: 157-162.

[16]. Subasinghe, R. (1997). Live fish handling and exportation. Information fish International 2: 39-41.

[17]. Wildgoose, W. (1998). Skin disease in ornamental fish: identifying common problems. J. Practice., 5: 226-243.

[18]. Athanassopoulou, F., Billinis, C. and Prapas, Th. (2004). Important disease conditions of newly cultured species in intensive freshwater farms in Greece: first incidence of nodavirus infection in Acipenser sp. J. Dis. Aquatic Organisms., 60: 247-252.

[19]. Garcia, F., Fujimoto, R. Y., Martins, M. L. and Moraes, F. R.(2009). Protozoan parasites of Xiphophorus spp. (Poeciliidae) and their relation with water 298 characteristics. J. ArquivoBrasileiro de MedicinaVeterinária e Zootecnia, 61 (1):156162.

[20]. Bichi, A. H. and Yelwa, S. I. (2010). Incidence of piscine parasites on the gills and gastrointestinal tract of clarias Gariepinus (Teugels) at Bagauda fish farm, Kano. Bayero Journal of Pure and Applied Sciences, 3 (1): 104-107.

[21]. Bahri, S. And Marques, A. (1996). Myxosporean parasites of the genus Myxobolus from Mugil cephalus in Ichkeul lagoon, Tunisia: description of two new species. Journal Diseases of Aquatic Organisms, 27 (14): 115-122.

[22]. AL-Bassel, D. A., AL-Swaehly, A. I., Abd EL-Baki, A. S., Atwa, M. T. and ALShawsh, R. M. (2009). Parasites of Mullets from two different water. International congress Geotunis.

[23]. Gbankoto, A., Pampoulie, C., Marques, A. And Sakiti, G. N. (2001). Occurrence of myxosporean parasites in the gills of two tilapia species from Lake Nokoué (Bénin, West Africa): effect of host size and sex, and seasonal patterns of infection. Journal Diseases of Aquatic Organisms, 44 (10): 217-222.

[24]. Navratll, S. (1991). Parasitoses in the fry of selected freshwater fish species under the condmons of stripping and rearing . J. Acta. Veter. Brno., 60: 357-366.
[25]. Kim, J., Hayward, C. J., Joh, S. and Heo, G. (2002). Parasitic infections in live freshwater tropical fishes imported to Korea. J. Diseases of Aquatic Organisms, 52: 169-173.
[26]. Ogut, H., Akyol, A. and ZekiAlkan, M. (2005). Seasonality of Ichthyophthirius multifiliis in the Trout (Oncorhynchus mykiss) Farms of the Eastern Black Sea Region of Turkey. Turk. J. Fisheries Aquatic Sciences, 5: 23-27.
[27]. Zrncˇic, S., Oraic, D., Sˇosˇtaric, B., C´aleta, M., Bulj, I., Zanella, D. and Sˇurmanovic, D. (2009). Occurrence of parasites in Cobitidae from Croatian rivers draining into two different watersheds. J. Appl. Ichthyol., 1-4.
[28]. Maceda-Veiga, A., Salvadó, H., Vinyoles, D. and De Sostoa, A. (2009). Outbreaks of Ichthyophthirius multifiliis in Redtail Barbs Barbushaasi in a Mediterranean Stream during Drought. J. Aquatic Animal Health, 21: 189-194.
[29]. Urawa, S. and Yamao, S.(1992). Scanning Electron Microscopy and Pathogenicity of Chilodonella piscicola (Ciliophora) on Juvenile Salmonids. Journal Aquatic Animal 4: 188-197.
[30]. Mitra, A. K. and Haldar, D. P. (2005). Descriptions of Two New Species of the Genus Trichodina Ehrenberg, 1838 (Protozoa: Ciliophora: Peritrichida) from Indian Fresh Water Fishes. J. Acta. Protozool., 44: 159-165.
[31]. Nilsen, F. (1995). Description of Trichodina hippoglossi n. sp. from farmed Atlantic halibut larvae Hippoglossus hippoglossus. J. Diseases of Aquatic Organisms, 21: 209214.
[32]. Hassan, M. A. H. (1999). Trichodiniasis in Farmed Freshwater Tilapia in Eastern Saudi Arabia. J. KAU: Marine. Sci., 10: 157-168.
[33]. Asmat, G. S. M. (2005). Trichodinidectoparasites (Ciliophora: Trichodinidae) of fishes in India. J. Agri. Biol. Sci., 1 (1): 31-37.
[34]. Isaksen. And Einar, T. (2003). Protozoan ectosymbionts on Atlantic salmon (Salmosalar L.) in a Hatchery in Hordaland, Western Norway: Morphology and Epizootiology.
[35]. Ramadan, H. H.(1991). Effect of host species, sex, length, diet and different seasons on the parasitic infection of Tilapia fish in Lake Manzalah. J. KAU: Marine. Sci., 2: 81-91.
[36]. Poulin, R. (1996). Sexual inequalities in Helminth infections: a cost of being a male. J. Am. Nat., 147: 287-295.
[37]. Paperna, L. (1996). Infections with Dinoflagellids and Ichthyophthiriasi: Parasites, infections and diseases of fishes in Africa .Analsupdate. Rome, FAO. 2nd ed. pp: 220.
[38]. Gbankoto, A., Pampoulie, C., Marques, A., Sakiti, G. N. and Dramane L. (2003). Infection patterns of Myxobolus heterospora in two tilapia species (Teleostei: Cichlidae) and its potential effects. J. Diseases Aquatic Organisms, 55: 125-131.
[39]. Bichi, A. H. and Ibrahim, A. A. (2009). A survey of ecto and Intestinal parasites of Tilapia Zillii (gervias) in Tiga Lake, Kano, Northern Nigeria. Bayero J. Pure. Appl. Sci., 2 (1): 82.
[40]. Koura, E. A., Abd El-Aziz, A. M., Kamel, E. G. and El-Deep, N. I. (1998). Protozoan parasites from two common freshwater fish (Barbusbynni and Synodontisschall) in Egypt. J. Aqua. Biol. Fish., 2 (4): 275-298.