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PREVALENCE OF ECTOCILIATE DISEASES IN CULTURED FRESHWATER FISH AT KAFR EL-SHEIKH GOVERNORATE

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ABSTRACT

A total number of 1600 cultured freshwater fish species; Oreochromis niloticus (O. niloticus), Clarias garepinus (C. garepinus), Ceprinus carpio (common carp) and Mugil cephalus, 100 of each fish species per season with different weights and sizes, were examined for the presence of common ciliated protozoal diseases affecting the cultured freshwater fish;which revealed the presence of (Trichodina, Chilidonella, Ichthyophthirius multifillis, Apizoma, Epistylis),in relation to their seasonal incidence. The clinical signs and postmortem lesions of diseased fish were recorded. Some heamatological and serum biochemical parameters of diseased fish were reported. The histopathological alterations in skin,gills and fins of naturally diseased fish with ectociliates were also reported.

INTRODUCTION

Kafr El-Sheikh governorate, has the highest fish production rate all over Egypt from either owned or temporarily private fish farms; 109,725 and 214,900 MT per 31,350 and 61,400 acres (feddan), respectively ***(Fish Statistics Year Book, 2012).***

Generally, in Egypt at Kafr El-Sheikh governorate in particular; the water supply of the fish farms is mainly the agriculture drainage water that may be sometimes mixed with sewage wastes; which is considered an ecological stress and predisposing factors paving the way for the prevalence of either external or internal parasitic diseases in cultured fishes.

Fish parasites producing diseases has a great effect on fish productivity through mortalities, slow growth rates as well as low grade quality meat ***(Limit, 1991 and Floyed, 2003)***, which might be refused by the consumers, which in turn have low economic impact.

Pathogenicity of fish ectoparasites affecting the skin and gills of cultured freshwater fish is very important because of its severe skin damage ***(Otify et al., 1991)*.**

The present work was planned to study the most common ciliated protozoal diseases affecting the cultured freshwater fishes in Kafr El-Sheikh governorate.

MATERIALS AND METHODS

1. Fish samples:

A total number of 1600 cultured freshwater fish species; *O. niloticus*, *C. garepinus*, *C. carpio* and *Mugil cephalus*, 100 of each fish species per season with different weights and sizes were collected alive from different fish farms at Sedi-Salem district, in Kafr El-Sheikh governorate, and transferred according to ***Hetrick (1983)***, and holded in prepared glass aquaria in the laboratory of fish diseases and managmenet dept., Faculty of Veterinary Medicine, Kafrelsheikh University and the Central Laboratory of AquaCulture Research, Sakha Unite.

2. Aquaria:

Full equipped glass aquaria were used for holding fish throughout the period of examination according to the method described by ***Innes (1966)***.

3. Clinical signs and post-mortum examinations:

The live collected fishes held in glass aquaria were immediately examined grossly by naked eye and with the aid of magnification lens to determine the abnormal changes on the external body surface, e.g. skin discoloration, fins and gills errosions, swellings,hemorrhages, ulcerations and exophthalmia …. etc. The examinations were carried out according to the methods described by ***Lucky (1977) and Woo (1995).***

4.Parasitological examinations:

4.1. Examination of skin and fins:

Direct smears were obtained from the two lateral sides of the skin, as well as the fins. The skin and fin scrapings were mixed with few drops of distilled water and examined microscopically, using both low and high magnification powers according to ***Lucky (1977)***.

4.2. Examination of gills:

The gill arch and filaments were scraped; a few drops of distilled water were added to obtain a uniform distribution under the entire cover slip; and examined under the microscope according to ***Lucky (1977)***.

4.3. Mounting and fixation of ciliates:

Gills were examined immediately to avoid the disintegration or escape of the external protozoa. Smears for protozoal examination were taken very thin and allowed to dry for 2-3 minutes and fixed with

absolute methyl alcohol for 5 minutes. The fixed slides were then stained with freshly diluted Giemsa stain for 30-45 minutes and impregnated in dense canda balsam then left to dry in the incubator at 37± 1c for 24 hours for driving any bubbles. Examinations of both fresh and stained smears were carried out under low, high objectives and oil immersion lens**es** according to the methods adopted by ***(Lucky, 1977 and Kabata 1985)*.**

4.4. <u>Identification of collected ciliates</u>:

The collected parasites were identified according to the identification keys of ***Blanchard (1885), Faure-Fermiet (1905), Paperna (1996), El-Tantawy and El-Sherbiny (2010a,b).***

5. Hematological and serum biochemical examinations:

The total count of red blood cells and white blood cells, as well as the packed cell volume (PCV) were determined according to ***Stoskopf (1993)*.** The Haemoglobin content was determined by the Sahli's method as well as the differential leucocytic count films were prepared and stained according to ***Lucky (1977)*.** The percentage and absolute value for each type of leucocytic cells were calculated according to ***Schalm (1986)*.**

The total serum proteins as well as serum albumin were determined colorimetrically at the wave length, 450 nm and 630 nm, respectively according to ***Peters (1970)***. Serum globulin was calculated acc. to ***Doumas and Biggs (1972)*.** Albumin globulins ratio was determined according to ***Coles (1974).*** The serum alkaline phosphatase was determined colorimetrically at the wave length 510 nm according to ***Kind and King (1954).*** Serum asparatate aminotransferase (S AST) and serum alanine

aminotransferase (S.ALT) were determined colorimetrically at the wave length 546 nm, according to ***Reitman and Frankel (1957).*** Phagocytic activity and phagocytic index were determined according to ***Kawahara et al. (1991)***.

6. Histopathological examination:

From the sacrificed naturally infected *Oreochromis niloticus, Clarias garepinus, Ceprinus carpio* and *Mugil cephalus,* tissue specimens were taken from the infected organs (gills, skin, and fins) fixed in 10% buffered formaline saline and dehydrated through different concentrations of ethyl alcohol, treated with xylol then blocked in paraffin boxes, according to ***Roberts (1978)***. Sections of 4-5 microns thickness were mounted on cleaned slides, stained by Haematoxyline and Eosin technique, ***(Carleton et al., 1967).***

RESULTS AND DISCUSSION

1. Clinical and post mortem examinations:

The external gross lesions of the naturally ciliate infected fish revealed, emaciation,dark or pale body coloration, excessive amounts of mucous on the external body surface, Scale detachment **(Fig. 1)**, hemorrhages, wounds and ulcers **(Fig. 2 and 3)**, were also present, ***(El-Khatib, 2003 and Abboud, 2001),*** which may be contributed to the continuous irritation of ciliated protozoa on the fish, while the mucous was released to relief the irritating inflammatory reaction (***Khalil, 2010; Marrzouk, 2002 and Mohammed et al., 2004)***. Exthophthalmia and corneal opacity **(Fig. 4)** was also reported ***(Abd El-Aal, 2002).***

On autopsy of naturally ciliate infected fish; the liver and spleen may be pale anemic or dark congested in coloration with distended gallbladder. The stomach was bulged with food and the intestine was

congested and containing mucoid secretion as well as abdominal dropsy, **(Fig. 5)**, ***(Rawia Adway, 2000; Ibtsam, 2004 and Osman, 2005)***.

2. Parasitological examination:

Microscopic smears were taken from gills, skin and fins of examined fishes, revealed some ciliated protozoans. *Trichodina*, has an adhesive discs with flat lateral projections. The upper view is round, while the lateral view is either dish when standing or bell-shaped when free swimming in the water, **(Fig.6).**

Chilodonella sp., appeared as large, flattened, ovoid shaped or heart shaped ciliates with bands of cilia along the long axis of organisms. A single oval to round macronucleus as well as round micronucleus, **(Fig.7)**. *Icthyophthirius multifilliis*, has large round to oval shape ciliated parasites from 0.5 up to 1 mm in diameter. They have macronucleus embedded in the protoplasm and characterized by a horseshoe, cresented or C-shape. The micronucleus is spherical, very small, **(Fig.8)**.

Apisoma sp.,has a vase-like shape and oral ciliated parasites. The parasite have a pyriform nucleus and small scopula, **(Fig.9)**. *Epistylis sp*., is a sessile, ciliated protozoans that propagates as colonies at the end of non-contractile stalks,**(Fig.10)**.

3. Incidences of fish ciliates among different fish species and seasons:

In general, the incidence of different ciliated fish protozoans among different fish species; *O. niloticus, M. cephalus, C. garipenus* and *C. carpio*; in different seasons cleared that, the higher incidence were observed in summer followed by spring then autumn and the lowest incidence in winter season (Table 1).

The highest parasitic infection level of Ich. was observed in *C.garipenus* in summer season. The highest prevalence of *Trichodina* was observed in *C.carpio* in winter season. While the highest incidence of *Chilodonella* was recorded in *C.carpio* and *C.garipenus* in spring season. As well as, the highest prevalence of *Apizoma* was reported in *C.garipenus* in both summer and autumn season. The highest infection level of *Epistylis* was recorded in *C.garipenus* in autumn season, (tables 2, 3 4 and 5).

Tawfik (2005) recorded a higher prevalence of ciliated protozoans in winter; rather than a higher prevalence of spring and autumn that reported by ***Hoffman (1987), Hassan (1992), El-Khatib (1993), Osman (2001) and Rashed (2013).*** Also, the results are somewhat similar to those reported by ***Jeronimo et al. (2011)*** where a 100% prevalence of *Epistylis magna* during winter season. On contrast, ***Abd El-Gawad (2004)*** recorded a highest prevalence of Apizomiasis in *C. garipenus* in spring (4.88%) and not detected in other seasons in Sharkia province; these contraversery may be due to the differences in culture system and environmental farm conditions ***(Yatabe et al., 2011).***

Badran et al. (1996) reported that Apizomiasis, Epistylosis and Trichodinosis had a higher incidence (4.5%) in spring season as well as, ***Noor El-Deen (2000)*** for trichodinolosis only. ***Babiker (2013)*** mentioned that there was no significant difference between *O. niloticus* and *C. garipenus* for protozoal parasitic infection in both cultured and natural environments. On the other hand, the results of the present study, were in contrary with the findings of both ***El-Sayed (1993) and El-Khatib (1993)*** that mentioned, the highest percentage of ciliated protozoal infections were observed in *O. niloticus* followed by *C. garipenus*; in spring.

Also, ***Abd Elmegiud (1989), Eissa (2002) and Rashed (2013)*** recorded that *Ichthyophthirius multifiliis*, has a higher prevalence in *C. carpio* in summer and spring seasons. Although, ***Rashed (2007)*** found that *Ichthyophthirius multifiliis*, reach the maximum rate of infection during winter season in Kafr El-Sheikh governorate.

Hassan (1992), El-Khatib (2003), Ibtsam (2004), Awad (2007) and Doaa El-Moghazy (2008) reported that the incidence of fish ciliated protozoans in Egypt; highly prevalence mainly in summer season, because of the higher temperature in summer was suitable for parasitic reproduction. On the other side, neither ***Paperna and Vanas (1983) nor Jerônimo et al. (2011)*** mentioned that the higher incidence in summer but, was confirmed in cooler seasons; these differences may be attributed to different geographic regions, water sources and fish species ***(Eissa, 2002 and Saleh and El-Nobi, 2003)***. ***Bassiony (2002)*** mentioned that the most important protozoan ciliate infections occur in autumn. ***Doaa El-Moghazy (2008) and Abu Elkheir (2006)*** reported that the lower incidence of Apizomiasis in *C. garipenus* at Sharkia, Dakahlia and Kafr El-Sheikh governorates, was in autumn season.

Mohammed (1996) reported that *O. niloticus* infected with Epistylosis in Suez canal area, had the lower infection rate during autumn season; Somewhat similar to ***Abd El-Khalek (1998)*** that recorded the same results in Beni-Suef province and ***Gharib (2005)*** in Kafr El-Sheikh province, ***Younis (1999)*** recorded the highest prevalence of Epistylosis in *O. niloticus* at Beni-Suef area, in winter season; rather than that recorded in the present study (autumn).

4. Haematological investigations on protozoan infected fish:

The Haematological investigations of (RBCs, WBCs, Hb, PCV, DLC) on protozoan infected fish were summarized in (tables 6-14). ***Murad and Mostafa (1988); Ibtsam (2004) and Tavares-Dias et al. (2002)*** reported a lower erythrocytic counts,low haematocrite and haemoglobin readings and a higher leucocytic count in catfish; although ***Azevedo et al. (2006)*** stated that the total number of erythrocytes and leucocytes, didn't show relation with the ecto-parasites infections. ***Hines and Spira (1973)*** reported that there no any alterations in WBCs and leukocyte count in the course of *Ichthyophthirius multifiliis* in common carp is dynamic and probably related to its severity.

Liu et al. (2004) mentioned that *Ichthyophthirius multifiliis*, render fish very susceptible to other fish pathogens which may be reflected in fluctuations of various haematogram components. ***Alvarez Pellitero (2008)*** mentioned that ciliated protozoa, may modulate inflammatory reactions in fish. ***Nadia Mahfouz (1997)*** reported that the ciliate parasites stimulate granulocytes synthesis, that disturb the values of differential leucocytic counts. ***El-Seify et al. (2003)*** reported an increase in differential leucocytic counts in infected fish except for eosinophiles, which are less significantly changed. Although, ***Morad and Mostafa (1998)*** recorded an increase in eosinophils and monocytes.

5. Blood serum analysis of protozoans infected fish:-

The total serum proteins,albumin,globulins,A/G ratio,ALT,AST and ALP of protozoan infected fish are summarized in tables (15 -21).

El-Seify et al. (2003) recorded that total proteins, globulins and albnumin were decreased in ciliated infected *O. niloticus*. ***Nadia Mahfouz (1997)*** mentioned that total protein and albumin had significantly decreased in infected fish with ciliated protozoa; while, the globulins were higher inspite of, lower A/G ratio. Although ***Awad (1992)*** recorded that the total serum proteins didn't show any significant changes between naturally infected and apparently healthy fish.

The obtained enzymatic serum values (AST, ALP and ALT) in the present study are somewhat higher than that detected by ***Bassiony (2002); Osman (2005); Ibtsam (2004) and Rashed (2013)***.

6. The phagocytic activity and phagocytic index :

Results of phagocytic activity and index are summarized in tables (22 and 23).

This increase in the PA and PI values were also reported by ***Stosik (2002), Kollner et al. (2004), Tavares-Dias (2007) and Rashed (2013).*** Also, ***Tavares-Dias (2002)*** mentioned that Ichthyophthiriasis in Nile tilapia showed an increase in phagocytic activity. ***Coles (1986)*** stated that the increasing phagocytic activity was attributed to the increasing lymphocytic numbers.

7. Histopathological findings:

Alterations caused by ciliates on gills of examined fishes showed many degenerative changes in both primary and secondary gill lamellae in the form of hyperplasia of epithelial cell proliferations, especially in

the secondary gill lamellae, In addition to leucocytic cell infiltrations. Worthy, this alterations were severe in Trichodinosis. In addition to congestion,eosinophilic infilteration and granulosis in the gill arch and gill lamellae, **(Fig.11)**. This picture was also reported by ***Roberts (2012), Osman (2001) and Noor El-Deen et al. (2014).*** The pathological gill alterations of Chilodonelosis may be attributed to their nourishing action on the cell of the gill lamellae, reproduce rapidly leading to destruction of the gills.

A multifocal coalescing areas of degeneration, epithelial necrosis and ulceration of the skin, Indeed, progressive cellular destruction and hyperplasia of epithelial cells especially the mucous cells. This alterations were evenly distributed due to the infections of *Apizoma, Epistylis, Chilodonella* and *Ichthyophthirius multifiliis*, ***FAO (2013) and De Padua et al. (2014).*** The skin ulcers and gill damage, might cause a portal of entry to secondary infections.The epithelial hyperplasia, mucous cell proliferations and necrosis in the gill tissues might limit the osmoregulatory gas and ion exchanges in the fish leading to metabolic disturbances being lethal to the host, **(Fig.12-17)**.

CONCLUSION

The ecological stress factors, like the organic matter load, ammonia, defficiency of oxygen, extravagance use of fertilizers as well as the other relevants, in the water environment play an important role, in the onset and spread of the parasitic diseases notably, the ectoparasitic ones, therefore special care should be adopted for the water environment to reduce aforementioned predisposing factors.

Fig. (1): *O. niloticus* with a large area of scale detachment at the lateral side and caudal fin erosion

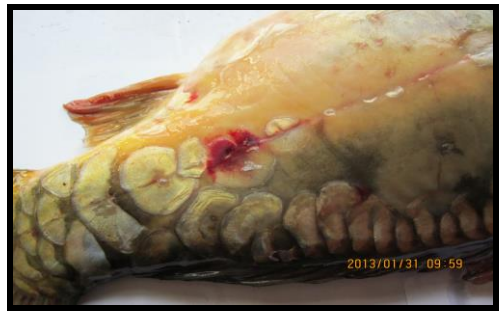

Fig. (2): *C.carpio* showing a haemorrhagic ulder at the caudal peduncle

Fig. (3): *C. garipenus* showing scattered haemorrhagic ulcers and petications on the ventral aspects of head and abdomen

Fig. (4): *O. niloticus* with blurring eye, scale detachment and skin depigmentation

Fig. (5): *O. niloticus* with severe abdominal dropsy and exthophthalmia

(Plates of infected fishes)

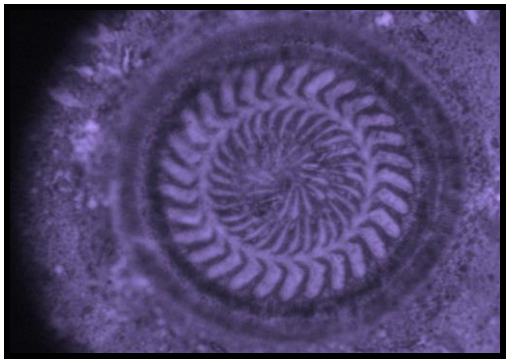

Fig. (6): Trichodina centrostriagata isolated from gills of *O. niloticus* (X400)

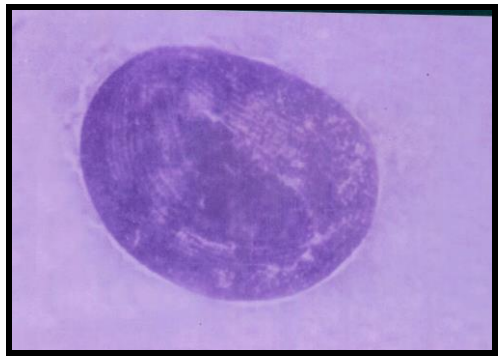

Fig.(7): Chilodonella hexasticha isolated from *O. niloticus* (X400)

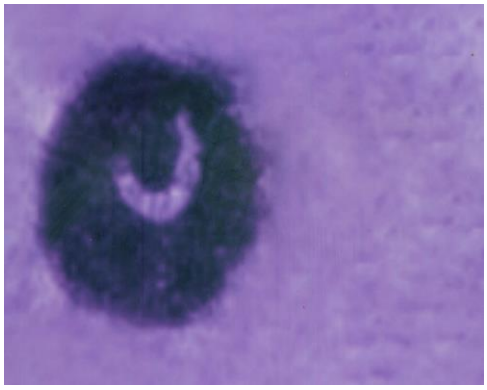

Fig. (8): *Ichthyophthirius multifiliis* isolated from skin of *C. garipenus* (X200).

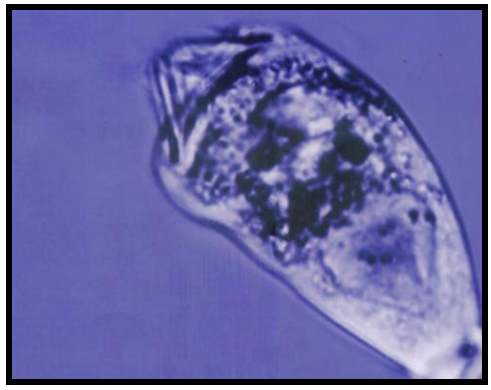

Fig. (9): Apisoma gasterostei isolated from skin of *C. carpio* (X200)

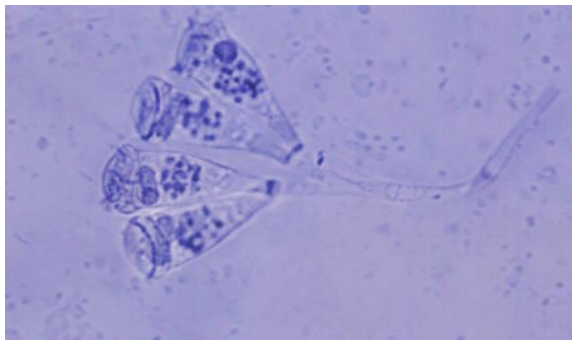

Fig. (10): Epistylis isolated from gills of *M. cephalus* (X200)

(Plates of isolated parasites)

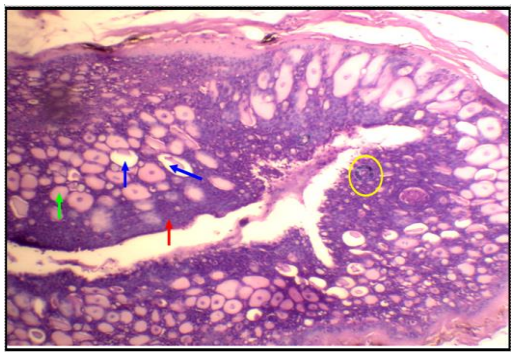

Fig. (11): Skin of *M. cephalus* infected with *Trichodina* (yellow circle) showing dermal odema (green arrow), numerous epidermal vacules (blue arrow) and inflammatory cell infiltration (red arrow) (X100 H & E).

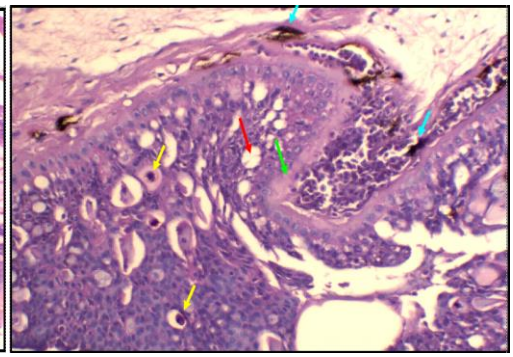

Fig. (12): Skin of *M. cephalus* infected with Apizoma (yellow arrow) showing, multifocal areas of hydropic degeneration(redarrow), progressive cellular destruction, melanosis (blue arrow) and loss of cell architecture (green arrow) (H & E X200)

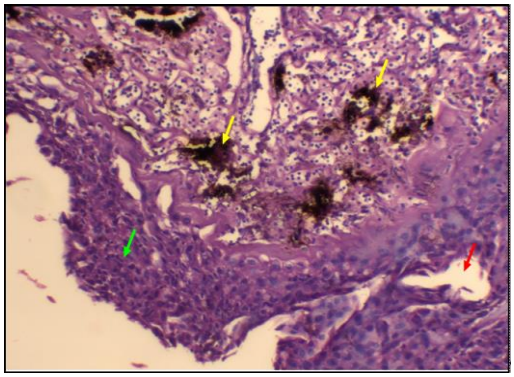

Fig. (13): Skin of *O. niloticus* infected with Epistylis showing mucus and cub cell proliferations (green arrow), multifocal areas and degeneration (red arrow) and inflammatory cell infiltration (yellow arrow) (H & E X100)

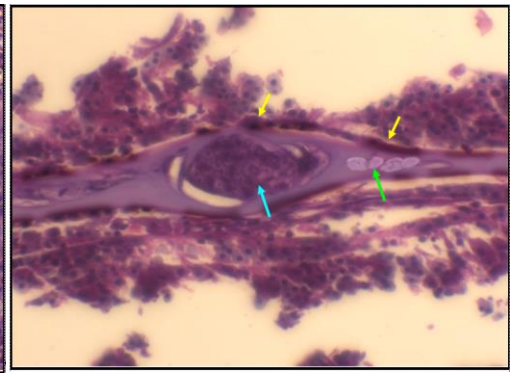

Fig. (14): Skin of *O. niloticus* infected with Chilodonella (blue arrow) showing accumulations of melanophores (yellow arrow) and epidermal invasion of the activated cub cells (green arrow) (H & E X100).

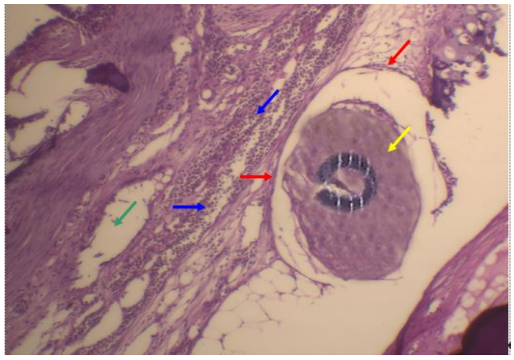

Fig. (15): Skin of *C. garipenus* infected with Ich. showing the horse shaped nucleus (yellow arrow), mucous cell proliferation (blue arrow), hyperplasia, hydropic degeneration (green arrow) and necrosis with ulceration around the parasitic attachment (red arrow) (H & E X200)

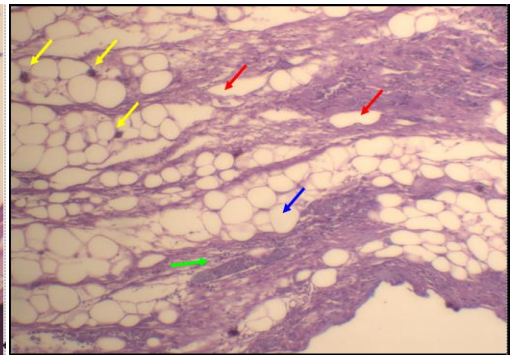

Fig. (16): Fin of *O. niloticus* embedded with Ich trophans (yellow arrow) and showing erosions (red arrow), epidermal separations (green arrow), shrinkage, atrophy and dermal vaculation (blue arrow) (H & E X100)

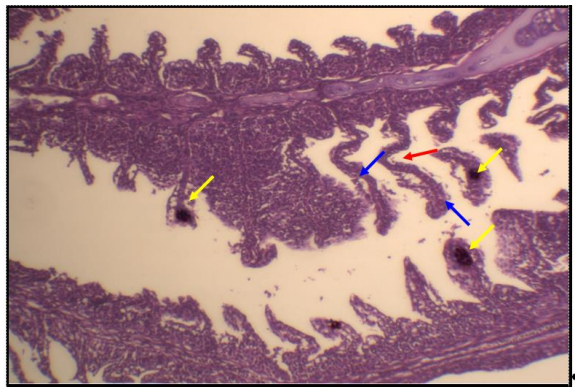

Fig. (25): Gills of *C. garipenus* embedded with trophont stages of Ich (yellow arrow) and showing elongation of secondary lamellae (blue arrow) and interlamellar hyperplasia (red arrow) (H & E X200)

Plates of Histopathological findings

Table (1): Incidence of infected fish species in different seasons.

Fish species	No. samples per season	Infection percent per season			
		Winter	Spring	Summer	Autumn
O. niloticus	100	40	60	66	55
M. cephalus	100	45	65	71	61
C. garepinus	100	80	77	80	77
C. carpio	100	60	75	75	66

Table (2): Incidence of ciliated protozoan diseases among different fish species in winter season.

Fish species	No. samples	No. infected samples	Infection percent					
			I. multifilis	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	100	40	15	8	4	4	5	4
M. cephalus	100	45	16	8	5	5	6	5
C. garepinus	100	80	20	15	10	3	4	28
C. carpio	100	60	20	17	8	4	4	7

Table (3): Incidence of ciliated protozoan diseases among different fish species in spring season.

Fish species	No. samples	No. infected samples	Infection percent					
			I. multifillus	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	100	60	18	12	6	7	4	13
M. cepohalus	100	65	19	13	7	8	7	11
C. garepinus	100	77	25	14	14	10	12	2
C. carpio	100	75	22	13	14	6	4	16

Table (4): Incidence of ciliated protozoan diseases among different fish species in summer season.

Fish species	No. samples	No. infected samples	Incidence percent					
			I. multifillus	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	100	66	15	14	12	6	9	10
M. cephalus	100	71	14	17	11	9	11	9
C. garepinus	100	80	28	10	10	12	10	10
C. carpio	100	75	21	13	11	8	7	15

Table (5): Incidence of parasitic diseases among different fish species in Autumn season.

Fish species	No. samples	No. infected samples	Incidence percent					
			I. multifillus	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	100	55	10	5	4	5	5	26
M. cephalus	100	61	11	6	5	6	6	27
C. garepinus	100	77	15	10	11	12	14	15
C. carpio	100	66	12	7	8	5	12	22

Table (6): The erythrothytic count of protozoan infected fish (x 10^6 mm).

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 1.20±0.20	C 1.11±0.10	B 1.15±0.15	D 1.19±0.11	C 1.19±0.11	B 1.19±0.11
M. cephalus	B 1.21±0.22	B 1.18±0.11	A 1.36±0.18	C 1.25±0.12	C 1.22±0.13	B 1.22±0.12
C. garepinus	A 1.40±0.40	A 1.50±0.50	A 1.35±0.13	A 1.40±0.14	A 1.60±0.16	A 1.44±0.14
C. carpio	B 1.22±0.21	B 1.20±0.20	B 1.18±0.18	B 1.33±0.13	B 1.40±0.14	B 1.25±0.12

Means within the same column of different litters are significantly different at P < 0.01).

Table (7): The leucocytic counts of protozoan infected fish (x 10^4/mm).

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 2.80±0.18	D 2.44±0.12	C 2.13±0.13	C 2.70±0.17	C 2.60±0.16	C 2.90±0.19
M. cephalus	C 2.85±0.19	C 2.57±0.12	B 2.19±0.13	C 2.75±0.17	C 2.66±0.16	C 2.95±0.19
C. garepinus	A 3.99±0.13	A 3.50±0.13	A 3.10±0.13	A 3.91±0.19	A 3.91±0.19	A 3.90±0.18
C. carpio	B 2.89±0.19	B 2.84±0.12	B 2.22±0.12	B 2.87±0.12	B 2.81±0.12	B 3.10±0.22

Means within the same column of different litters are significantly different at P < 0.01).

Table (8): The haemoglobin content of protozoan infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 8.20±0.12	C 9.20±0.19	B 8.44±0.14	D 7.90±0.19	D 8.0±0.18	C 8.70±0.17
M. cephalus	C 8.23±0.14	C 9.23±0.20	B 8.77±0.16	C 8.00±0.14	C 8.50±0.19	B 9.00±0.18
C. garepinus	B 8.55±0.15	B 9.55±0.15	A 9.60±0.16	B 8.55±0.15	B 8.90±0.19	D 8.50±0.15
C. carpio	A 9.5±0.15	A 9.70±0.18	A 9.70±0.17	A 9.40±0.14	A 9.80±0.18	A 9.80±0.18

Means within the same column of different litters are significantly different at P < 0.01).

Table (9): The PCV% values in protozoan infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 15.47±0.14	B 16.50±0.15	B 14.44±0.11	B 15.49±0.19	B 15.40±0.15	B 13.49±0.13
M. cephalus	A 16.50±0.15	A 16.55±0.12	A 15.43±0.12	B 15.55±0.20	B 15.44±0.16	B 13.55±0.14
C. garepinus	A 16.47±0.16	C 15.47±0.17	A 15.48±0.18	A 16.55±0.16	A 17.49±0.17	A 14.49±0.14
C. carpio	C 10.44±0.14	D 11.45±0.14	C 12.47±0.17	C 12.45±0.12	C 13.47±0.14	C 9.45±0.09

Means within the same column of different litters are significantly different at P < 0.01).

Table (10): The effect of parasitic infections on lymphocyte pecent in examined fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 48.5±4.15	C 46.55±4.15	C 44.47±4.17	B 46.44±4.16	B 43.44±4.13	B 48.5±4.19
M. cephalus	B 48.7±4.17	B 47.51±4.16	B 46.77±4.18	B 46.49±4.19	B 43.47±4.13	B 48.7±4.19
C. garepinus	A 49.55±4.49	A 48.60±4.16	A 49.55±4.19	A 49.55±4.15	A 45.55±4.15	A 49.55±4.15
C. carpio	C 42.33±4.13	D 40.35±4.13	D 39.33±4.14	C 40.22±4.12	C 38.33±3.19	C 43.33±4.13

Means within the same column of different litters are significantly different at P < 0.01).

Table (11): Eosinophilic percent in protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	D 14.43±3.14	C 13.33±3.19	D 14.44±4.16	C 13.33±4.13	D 13.30±3.14	D 13.44±1.34
M. cephalus	C 15.44±3.17	B 15.34±3.18	C 14.90±4.18	C 13.38±4.15	C 14.80±3.17	C 14.45±1.36
C. garepinus	A 17.54±4.15	A 17.54±4.17	A 17.52±4.12	A 16.44±4.11	A 18.55±2.16	A 16.44±4.17
C. carpio	B 16.77±4.17	B 15.78±4.19	B 16.78±4.17	B 15.44±4.17	B 15.78±2.17	B 15.33±3.15

Means within the same column of different litters are significantly different at P < 0.01).

Table (12): Basophilic percent in protozoals infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 11.88±1.19	C 10.89±1.19	B 11.83±1.14	C 10.88±0.18	B 10.88±0.88	C 10.88±1.18
M. cephalus	B 12.77±1.18	B 11.90±1.18	A 12.84±1.17	B 11.80±0.12	B 10.90±0.81	B 11.90±1.17
C. garepinus	A 13.64±1.16	A 12.33±1.12	A 12.44±1.12	A 12.64±1.11	A 11.64±0.66	A 12.64±1.14
C. carpio	D 8.89±1.18	D 7.88±1.18	C 8.88±0.77	D 8.89±0.99	C 7.89±0.77	D 7.88±0.78

Means within the same column of different litters are significantly different at P < 0.01).

Table (13): Monocytic percent in protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 8.44±0.14	C 7.33±0.17	B 6.34±0.16	B 7.30±0.17	B 7.32±0.17	C 8.31±0.18
M. cephalus	B 8.70±0.16	B 7.50±0.19	A 7.40±0.19	B 7.35±0.18	B 7.35±0.19	B 8.45±0.19
C. garepinus	A 9.40±0.19	A 8.44±0.18	A 7.43±0.17	A 8.41±0.18	A 8.42±0.18	A 9.42±0.19
C. carpio	C 7.30.44±0.17	B 7.44±0.17	B 6.43±0.16	B 7.41±0.16	B 7.41±0.14	B 8.43±0.14

Means within the same column of different litters are significantly different at P < 0.01).

Table (14): Neutrophilic percent in protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 24.55±2.24	C 23.44±2.24	C 24.56±1.17	C 25.54±2.26	C 25.45±2.24	C 26.58±2.29
M. cephalus	B 25.55±2.25	B 24.46±2.14	B 26.56±1.14	B 26.55±2.27	B 26.44±2.24	B 27.55±2.22
C. garepinus	A 26.27±2.28	A 26.28±2.26	A 27.20±2.18	A 27.28±2.29	A 27.28±2.29	A 28.29±2.28
C. carpio	D 21.5±2.21	D 21.55±2.24	D 22.15±2.22	D 23.50±2.23	D 22.5±2.25	D 22.53±2.53

Means within the same column of different litters are significantly different at P < 0.01).

Table (15): The total serum protein levels in protozoal infected fish (g/dL).

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 3.88±0.85	A 4.87±0.40	B 4.88±0.33	C 3.75±0.35	B 3.55±0.35	B 4.88±0.44
M. cephalus	A 4.88±0.55	A 4.89±0.40	A 5.88±0.33	A 4.75±0.35	C 3.53±0.35	C 4.22±0.44
C. garepinus	B 4±0.42	B 4.12±0.42	B 4.55±0.45	B 4.22±0.22	A 4.77±0.47	A 5.52±0.51
C. carpio	B 4.09±0.41	AB 4.55±0.41	A 5.66±0.51	A 4.66±0.46	A 4.99±0.45	A 5.66±0.44

Means within the same column of different litters are significantly different at P < 0.01).

Table (16): The serum albumin levels in protozoal infected fish (g/dL).

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 0.62±0.12	C 0.60±0.16	C 0.61±0.44	C 0.60±0.42	D 0.61±0.45	C 0.64±0.16
M. cephalus	C 0.63±0.11	BC 0.61±0.16	B 0.67±0.44	B 0.64±0.42	Cb 0.65±0.44	C 0.65±0.18
C. garepinus	B 0.66±0.16	BC 0.62±0.55	C 0.63±0.55	B 0.63±0.43	A 0.74±0.42	A 0.77±0.14
C. carpio	A 0.76±0.17	A 0.73±0.45	A 0.72±0.45	A 0.73±0.45	B 0.70±0.45	B 0.70±0.17

Means within the same column of different litters are significantly different at P < 0.01).

Table (17): The serum globulin levels in protozoal ciliates infected fish (g/dL).

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 3.26±0.27	A 4.27±0.29	C 4.27±0.39	D 3.15±0.33	B 2.94±0.44	C 4.24±0.44
M. cephalus	A 4.25±0.25	A 4.18±0.28	A 5.21±0.55	A 4.11±0.45	B 2.88±0.29	D 3.57±0.55
C. garepinus	B 3.34±0.28	B 3.50±0.29	D 3.92±0.44	C 3.59±0.39	A 4.03±0.44	B 4.75±0.44
C. carpio	B 3.33±0.35	B 3.82±0.55	B 4.94±0.44	B 3.93±0.44	A 4.29±0.44	A 4.96±0.66

Means within the same column of different litters are significantly different at P < 0.01).

Table (18): The albumin/globulins ratio in protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 5.25±0.26	A 7.11±0.55	B 7±0.82	C 5.25±0.55	C 4.81±0.84	D 3.50±0.55
M. cephalus	A 6.74±0.28	B 6.85±0.66	A 7.78±0.77	A 6.43±0.66	D 4.43±0.44	C 5.49±0.49
C. garepinus	B 5.06±0.35	C 5.64±0.64	D 6.23±0.69	B 5.69±0.66	B 5.44±0.44	B 6.17±0.61
C. carpio	C 4.38±0.43	C 5.23±0.55	C 6.86±0.86	C 5.38±0.88	A 6.12±0.62	A 7.08±0.70

Means within the same column of different litters are significantly different at P < 0.01).

Table (19): The S.ALT levels (U/I) in protozoal ciliates infected fish .

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	D 76.45±6.44	D 73.44±4.70	D 76.45±4.75	D 77.45±4.77	D 75.45±4.75	D 77.40±4.71
M. cephalus	C 78.45±6.45	C 75.44±4.72	C 78.45±4.76	C 79.45±4.79	C 80.43±4.80	C 82.40±4.90
C. garepinus	A 85.77±5.71	B 81.77±4.72	A 86.77±6.77	A 85.77±5.77	A 84.77±4.80	A 87.77±4.77
C. carpio	B 82.44±4.44	A 82.43±4.45	B 83.44±4.88	B 83.43±488	A 83.44±4.88	B 83.40±3.88

Means within the same column of different litters are significantly different at P < 0.01).

Table (20): The S.AST levels (U/I) in protozoans infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 24.88±4.87	C 25.88±5.44	C 25.88±2.37	C 23.88±3.84	C 23.87±3.88	C 25.88±2.87
M. cephalus	B 26.89±4.88	B 27.89±5.45	B 27.88±2.38	B 25.88±3.85	B 25.88±3.88	B 27.89±2.88
C. garepinus	A 30.24±3.22	A 31.24±3.44	A 30.22±2.34	A 31.24±2.31	A 30.22±3.22	A 32.24±3.22
C. carpio	D 18.22±3.82	D 19.22±1.20	D 18.25±2.44	D 18.21±2.35	D 19.22±2.19	D 20.22±2.24

Means within the same column of different litters are significantly different at P < 0.01).

Table (21): The S.ALP levels (U/I) in protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 14.77±1.71	C 14.55±1.14	C 13.22±1.14	B 13.44±1.15	AB 15.44±1.16	B 12.43±1.12
M. cephalus	B 15.76±1.72	B 15.57±1.15	B 14.22±1.15	AB 14.45±1.16	AB 15.49±1.18	AB 12.19±1.19
C. garepinus	A 16.77±1.16	A 16.55±1.15	A 15.55±1.16	AB 14.66±1.16	A 16.66±1.17	A 13.63±1.13
C. carpio	D 13.36±1.14	D 13.34±1.14	D 12.33±1.14	B 12.44±1.12	B 14.44±1.14	AB 13.45±1.13

Means within the same column of different litters are significantly different at P < 0.01).

Table (22): The phagocytic activity (PA) of protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	C 34.33±3.33	C 40.55±4.25	D 36.22±4.12	D 22.25±3.22	D 44.55±4.25	C 55.66±5.66
M. cephalus	C 34.36±3.32	B 42.56±4.55	C 40.22±5.12	C 28.25±4.23	C 45.56±4.22	B 56.65±4.65
C. garepinus	A 37.33±3.34	A 44.45±4.56	A 55.44±5.15	A 33.24±3.24	A 50.22±5.22	A 57.88±5.78
C. carpio	B 35.22±3.35	B 41.22±4.12	B 52.43±5.17	B 30.22±3.25	B 46.77±4.22	B 56.55±5.56

Means within the same column of different litters are significantly different at P < 0.01).

Table (23): The phagocytic index (PI) of protozoal ciliates infected fish.

Fish species	*I. multifillus*	*Trichodina*	*Chilodenilla*	*Apizoma*	*Epistyles*	Mixed infections
O. niloticus	B 4.24±0.14	A 6.79±0.16	C 4.32±0.13	D 3.45±0.16	A 6.33±0.16	A 4.43±0.14
M. cephalus	B 4.27±0.14	A 6.70±0.18	C 4.34±0.14	C 3.70±0.18	A 6.43±0.17	A 4.44±0.14
C. garepinus	A 4.35±0.13	A 6.80±0.18	B 5.44±0.15	B 4.20±0.15	B 5.22±0.15	A 4.45±0.15
C. carpio	A 4.37±0.17	B 6.44±0.14	A 5.43±0.12	A 4.22±0.13	A 6.70±0.17	A 4.50±0.14

Means within the same column of different litters are significantly different at $P < 0.01$).

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بعض الدراسات على أمراض الأوليات الهدبية فى أسماك المياه العذبة بمحافظة كفرالشيخ

في هذه الدراسة تم فحص 1600 سمكة مياة عذبة من انواع البلطي النيلي ، القرموط الافريقي ، المبروك العادي والبوري ، 100 سمكة من كل نوع في كل فصل من فصول السنة ، مختلفة الاحجام والاوزان ، وذلك لاستبيان الامراض الشائعة التي تسببها الأوليات الهدبية ، حيث تم عزل وتصنيف طفيليات التريكودينا ، الكيلودينلا،الاكثيوفثيريس ملتيفيلس ، الابيزوما والابستيلس،ونسب حدوثها فصليا.

تم تسجيل الاعراض الخارجية والافات التشريحية للاسماك المريضة .ايضا تم اجراء بعض الفحوص الدموية والبيوكيميائية للاسماك المصابة وتسجيل نتائجها ، تم دراسة وتسجيل بعض التغيرات النسجية علي جلد وخياشيم وزعانف الاسماك المصابة طبيعيا بالاوليات الهدبية.