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ORIGINAL ARTICLE

Prevalence and seasonal variation of ectoparasites in cultured Nile tilapia *Oreochromis niloticus* in Saudi Arabia

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Abstract The prevalence, mean intensity and abundance of ectoparasites (monogeneans and trichodinids) from Nile tilapia *Oreochromis niloticus* were investigated during different seasons of two consecutive years, from January 2011 to December 2012. A total of 360 *O. niloticus* was collected from three fish farms located in the central region of Saudi Arabia. Prevalence, mean intensity and mean abundance of monogeneans on fish gills were found to be significantly ($p < 0.01$) higher in farm(C) (81.67, 495.23, 405.84 %) than farm (A) (7.5, 81.25, 8.34 %) and farm (B) (4.17, 62.5, 5 %) respectively. Similarly, the same parameters for trichodinids on gills were found to be significantly ($p < 0.01$) higher in farm (C) (97.5, 97.5, 97.5 %), followed by farm (A) (39.17, 234.37, 35.00 %) and farm (B) (6.67, 347.92, 30.00 %) respectively. The results of monogenean parameter on fish skin were found to be significantly ($p < 0.01$) higher in farm (C) (66.67, 443.68, 294.16) followed by farm (A) (16.67, 124.58, 21.67 %) then farm (B) (0.83, 25, 0.83 %) respectively. Similar results for trichodinid parameters on the skin were found to be higher ($p < 0.01$) in farm (C) (97.5, 875, 857.5 %), then farm (A) (26.67, 399.70, 215.01 %) and farm (B) (4.17, 154.17, 12.5 %) respectively. These results indicated that water quality and nutritional qualities were the major factors that affecting parasite occurrence, while the effect of temperature, seasonality and stocking density might have a secondary role on ectoparasite occurrence. Further studies should investigate that how the nutritional and water qualities affect the immunity of the fish to resist parasite infection.

Keywords Ectoparasites · Seasonality · Tilapia · *Oreochromis niloticus*

Introduction

Tilapias are among the most important commercial freshwater fish species in the world. It has become the main species cultured in Saudi Arabia, due to their rapid growth, hardiness and tolerates in a wide range of environmental conditions (Siddiqui and Al-Harbi 1995). Freshwater aquaculture in Saudi Arabia is one of the most important economic sectors that depend on the underground waters (Al-Harbi and Ali 2001). The limited water resources of the country make the intensification of aquaculture a necessity for the maximum utilization of the resources. Aquaculture in Saudi Arabia experienced some problems of parasite infection because of intensification and commercialization of aquaculture and the introduction of new species from other countries. Parasitic diseases are one of the serious hindrances of aquaculture development due to the great losses of fish fry and fingerlings in hatcheries that resulted in fish seed shortage for aquaculture development and losses of the growing fish.

A parasite is an individual that exist in close relationship for a considerable period of its life on or in its host from which it takes food or metabolic benefit (Whittington and Chisholm 2003). Ogawa (2008) stated that fish parasites show a great diversity of unicellular and multicellular groups of organisms. In many cases, fish production in

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aquaculture in a large scale, may be a companied by the outbreak of disease infections which are caused by Viral, protozoan and metazoan disease agents although most of them have-not yet been documented. Much consideration is concentrated on the economic loss caused by parasitic diseases in aquaculture. The major cause of parasitic infection on indigenous fish is the importation of foreign fish and shellfish. The health of the resident fish fauna is affected by human activities that change the aquatic environment and cause diseases to fish and eventually leading to their mortalities (Poulin 1992). Fish parasitic diseases are widespread all over the world especially in the tropics, (Roberts and Janovy 2000). Parasitism is one of the most widespread and successful form of life shown by living organisms (Poulin and Morand 2000).

Parasitic infections sometimes give indications of water quality since they commonly increase in polluted waters (Poulin 1992). Parasitology of fish is thus an essential means in aquatic health studies and the understanding of parasite biology is important for establishing mechanisms of control. Parasites and their hosts usually live in equilibrium (Bush et al. 2001). However, in crowd conditions of the hosts, such as in fish ponds, parasitic diseases can spread very rapidly and cause high mortalities (Paperna 1996). This is no typically happening in the wild, natural aquatic bodies unless polluted by human activities that affect the distribution of parasite communities.

Up-to-date very little attention has been paid to the fish parasites from the point of their effect on the host. The knowledge of fish parasitism can be of great practical importance for fish health. The health of the resident fish fauna is affected by human activities that change the aquatic environment and cause infection to fish and finally leading to their mortalities (Poulin 1992). Prevalence, intensity and the relative abundance of fish parasites can be used as a marker of environmental stress. Ectoparasites are in contact with water they will be less in abundance if they are sensitive to pollution (Madanire-Moyo and Barson 2010).

Parasitism is one of the most serious problems for cultured fish (Scholz 1999). Monogeneans and trichodinid are common ectoparasites on the fins, body surface and gills of fish and widespread throughout freshwater and marine habitats (Thoney and Hargis 1991; Basson and Van As 2006). Several species of monogenea and trichodinid have been implicated in the mortality of wild and cultured tilapia (Hassan 1999; García-Vásquez et al. 2007; Pariselle and Euzet 2009; Abd El-Galil and Aboelhadid 2012: Valladão et al. 2013). Although, tilapias are consider one of the most important freshwater fish species culture in Saudi Arabia, little research has been carried out on their parasitic diseases (Hassan 1999; Kalantan et al. 1999; Al-Harbi 2011; Abdel-Baki and Al-Quraishy 2014). The present study aimed to investigate the occurrence of ectoparasites such as monogeneans and trichodinid on gill and skin of the cultured tilapia and their association with farm management systems and the seasonality of occurrence.

Materials and methods

Study area and fish collection

The study was carried out in three fish farms located in the central region of Saudi Arabia namely: fish farm (A) at Al-Hayathem (24°09′54.25″N, 47°14′15.82″E), fish farm (B) at Al-Hazem (24°07′51.81″N, 47°08′59.75″E) and fish farm (C) at Tibrak (24°22′13.51″N, 45°53′21.48″E). A total number of 360 Nile tilapia (*Oreochromis niloticus*), between 20 and 100 g were collected bimonthly from three fish farms during the four different seasons of two consecutive years, from January 2011 to December 2012. Fish were collected with hand nets and transported live to the laboratory in polyethylene bags filled with air and water, where they were maintained in aerated glass aquaria until they were examined within maximum 3 days.

Water quality

The water samples were collected from at time of sampling using five wide mouth sterile plastic jars of 1 l capacity and usually from 10 to 15 cm depth from the water surface. Dissolved oxygen, temperature, conductivity, salinity and pH were measured on the spot at the time for sampling. The dissolved oxygen was determined by a digital oxygen meter (*HANNA-HI9142*) and the water temperature was measured by using mercury thermometer with an accuracy of 0.1 °C. Electrical conductivity (EC) was determined by using digital conductivity meter (*AD-31*: *EC/TDF)*. The water salinity (ppt) was determined by refractometer (model: Janway, M300, Hanna Instrument, USA). The water pH was measured by pH meter (*HANNA-HI98107*). For the study of nitrate–nitrogen, nitrite–nitrogen and ammonia–nitrogen were analyzed in the laboratory using DR\2010 spectrophotometer. The results of analysis where expressed as mg/liter except for temperature and conductivity they were measured as °C and millisiemens (mS/cm) respectively.

Fish examination and identification of parasites

Fish examination for external parasites (monogeneans and trichodinids) was done according to the modified methodology given by Kabata (1985). The fish were sacrificed by a blow to the head, and immediately, skin scrapes (smears) and gills from both sides were dissected and examined in

wet mounts under low-power microscope, for the presence of the ectoparasites. The total number of monogenea and trichodinid from the skin and gills from each fish were counted, and the prevalence, mean intensity and abundance data were calculated. The prevalence, mean intensity and abundance data were calculated according to Bush et al. (1997).

Statistical analysis

Statistical analysis were performed by ANOVA two factors without replications according to Sokal and Rohlf (1995) to compare seasonal variation in the three sites for each parameter. A significance level of $p < 0.05$.

Results

Management procedures of the fish farms

The three farms have different management procedures of aquaculture for the Nile tilapia (Table 1). Fish farm (A) adopted a semi-intensive system in rectangular concrete tanks with stocking density of (3–5 kg/m^2). The fish were fed commercial diet of 30–36 % proteins two times a day. Water aeration used during the night and emergencies. Water renewed once a week and water quality monitoring was not performed and fish mortality was frequently occurred in small numbers. Fish farm (B) used an intensive system in raceways. The fish were stocked at (6–10 kg/m^2) and fed with a commercial diet of 36 % proteins three times daily. The fish ponds were aerated continuously using 20 hp air pumps and fed with a continuous water flow. Water quality was not monitored regularly and fish mortality was rarely seen. Fish farm (C) was using an extensive system of fish culture in rectangular concrete tanks with low oxygen supply and poor water quality. Nile tilapia was stocked at (2–3 kg/m). The fish look starved emaciated with dull movement and dark coloration. Fish were fed on farm prepared diet of about 20 % plant proteins at one time or less per week. Daily fish mortality was very common.

Water quality

Water quality parameters were shown in Table 2. Oxygen level shows a high significant difference between the farms ($p < 0.01$), the highest oxygen level was 8.88 ± 0.67 mg/L in the spring in fish farm (B) and the lowest level was 2.18 ± 0.14 mg/L in fish farm (C) also in the spring and it showed no significant difference between the season ($p > 0.05$) (Table 2). The water temperature showed no significant difference neither between the seasons nor between the fish farms ($p > 0.05$), the highest and lowest temperatures were measured in fish farm (C) during the summer and winter respectively as 32.3 ± 1.83 and 18.5 ± 0.27 °C (Table 2). The pH of the water revealed that there was no significant difference between the fish farms or the seasons and its means ranges between 5.2 ± 0.2 in fish farm (C) during the winter and 7.5 ± 0.5 in fish farm (A) during the summer (Table 2). Ammonia-N showed highly significant differences between the farms and the seasons ($p < 0.01$), it reached the highest level 2.92 ± 0.66 mg/L in fish farm (C) during the summer and the lowest level 0.24 ± 0.41 mg/L in fish farm (B) during the winter (Table 2). Nitrite-N exhibited high significant difference ($p < 0.01$) between farms where the highest mean was measured as 1.61 ± 0.66 mg/L in fish farm (C) during the summer and the lowest mean was 0.27 ± 0.46 mg/L in fish farm (B) during the summer. Nitrate-N showed no significant difference ($p > 0.01$) neither between the farms nor between the seasons, it

Table 1 Management procedures of the studied Nile tilapia *Oreochromis niloticus* fish farms

Characteristics	Fish farms		
	A	B	C
Culture system	Semi intensive	Intensive	Extensive
Pond type			
Individual pond size	4 × 12 m (concrete)	4 × 20 m (concrete)	10 × 10 m (concrete)
Fish stocking density/m^2	3–5 kg	6–10 kg	2–3 kg
Feeding	2 times/day	3 times/day	1 time/week
Ration	Commercial tilapia feed 30 % protein	Commercial tilapia feed 36 % protein	On farm prepared diet 20 % protein
Aeration use	At night and emergencies via Fountains	Continuous air supply Via Pumps	For emergencies via pumps
Water renewal	(once a week)	Continuous water flow	Not regular
Water quality monitoring	No	Some times	No
Fish mortality seen	Some times a week	Frequently	Every day

A, B, C = Fish farms

ranges between (1.27 ± 0.24 mg/L in fish farm (A) during the summer and 4.57 ± 0.47 mg/L in fish farm (C) during the summer (Table 2). Salinity showed a significant difference ($p < 0.05$) between the farms, the highest mean was 4.78 ± 0.33 ppt in fish farm (C) during the autumn and the lowest was 3.1 ± 0.45 (ppt) in fish farm (A) during the autumn as well. Conductivity was significantly higher ($p < 0.05$) in fish farm (C) 276 ± 10.3 (µS/cm) during the winter and lower in fish farm (A) 145.2 ± 7.4 (µS/cm) both during the summer (Table 2).

Ectoparasitic prevalence, mean intensity and mean abundance

The seasonal prevalence, mean intensity and mean abundance of ectoparasites in the gills and skin of tilapia from the three fish farms are shown in Tables 3 and 4. The statistical analysis revealed that the prevalence, mean intensity and mean abundance of ectoparasites in the gill and skin of tilapia were significantly ($p < 0.01$) higher in fish farm (C) than fish farms (A) and (B) respectively (Tables 3, 4). Trichodina and monogenea showed highest variability in prevalence and abundance throughout the year in fish farm (C) (Tables 3, 4).

The prevalence of monogenea on the gill of tilapia in fish farm (A) ranged from 3.33 to 26.67 %, with mean prevalence of 16.67 %, mean intensity at 124.58 and mean abundance at 21.67 (Table 3). While the prevalence of trichodina on the gill of tilapia in fish farm (A) ranged from 16.67 to 43.33 % with mean prevalence of 26.67 %, mean intensity at 399.70 and mean abundance at 215.01 (Table 3). The prevalence of monogenea on the skin of tilapia in fish farm (A) ranged from 0.00 to 13.33 % with mean prevalence of 7.5 %, mean intensity at 81.25 and mean abundance at 8.34 (Table 4). While the prevalence of trichodina on the skin of tilapia in fish farm (A) were ranged from 10 to 100 %, with mean prevalence of 39.17 mean intensity at 234.37 and mean abundance at 35.0 (Table 4).

The prevalence of monogenea on the gill of tilapia in fish farm (B) ranged from 0.0 to 10 %,with mean prevalence of 4.17, mean intensity at 62.5 and mean abundance at 5.0 (Table 3). The prevalence of trichodina on the gill of tilapia in fish farm (B) ranged from 0.0 to 13.33, with mean prevalence of 6.67, mean intensity at 347.92 and mean abundance at 30.0 (Table 3). The prevalence of monogenea on the skin of tilapia in fish farm (B) ranged from 0.0 to 3.33 %, with mean prevalence of 0.83 %, mean intensity at 25 and mean abundance at 0.83 (Table 4). While the prevalence of trichodina on the skin of tilapia in fish farm (B) ranged from 0.0 to 10 %, with mean prevalence of 4.17 % mean intensity at 154.17 and mean abundance at 12.5 (Table 4).

The prevalence of monogenea on the gill of tilapia in fish farm (C) ranged from 70 to 100 %, with mean prevalence of

Table 2 The physico-chemical characteristics of the studied Nile tilapia *Oreochromis niloticus* fish Farms

Parameters	A				B				C			
	Autu ($\bar{x}$ ± SD)	Win ($\bar{x}$ ± SD)	Spr ($\bar{x}$ ± SD)	Sum ($\bar{x}$ ± SD)	Autu ($\bar{x}$ ± SD)	Win ($\bar{x}$ ± SD)	Spr ($\bar{x}$ ± SD)	Sum ($\bar{x}$ ± SD)	Autu ($\bar{x}$ ± SD)	Win ($\bar{x}$ ± SD)	Spr ($\bar{x}$ ± SD)	Sum ($\bar{x}$ ± SD)
Fish Farms												
D. Oxy. (mg/L)	5.2 ± 0.43	5.74 ± 0.39	4.30 ± 0.56	3.71 ± 0.33	7.82 ± 0.34	7.45 ± 0.57	8.88 ± 0.67	7.19 ± 0.53	2.7 ± 0.22	2.85 ± 0.14	2.18 ± 0.08	2.59 ± 0.16
Temperature (°C)	27. ± 1.34	20.1 ± 0.88	28.7 ± 1.01	31.9 ± 1.23	26.5 ± 0.76	21.1 ± 0.58	28.9 ± 0.99	31.5 ± 1.07	26. ± 0.87	18.5 ± 0.27	27.6 ± .96	32.3 ± 1.83
pH	6.9 ± 0.2	5.8 ± 0.4	6.7 ± 0.3	7.5 ± 0.5	6.5 ± 0.2	6.9 ± 0.4	7.3 ± 0.3	7.1 ± 0.7	5.2 ± 0.2	5.7 ± 0.1	6.8 ± 0.2	7.1 ± 0.9
Ammonia-N (mg/L)	1.5 ± 0.42	0.82 ± 0.24	1.11 ± 0.35	1.27 ± 0.63	0.31 ± 0.23	0.24 ± 0.41	0.46 ± 0.17	0.33 ± 0.46	2.01 ± 0.45	2.92 ± 0.66	2.41 ± 0.34	2.47 ± 0.73
Nitrite-N (mg/L)	0.4 ± 0.72	0.32 ± 0.34	0.46 ± 0.58	0.57 ± 0.56	0.52 ± 0.32	0.42 ± 0.54	0.41 ± 0.08	0.27 ± 0.46	1.5 ± 0.56	0.82 ± .049	1.41 ± 0.57	1.61 ± 0.66
Nitrate-N (mg/L)	2.8 ± 0.44	3.42 ± 0.57	3.41 ± 0.37	1.27 ± 0.24	4.52 ± 0.34	3.42 ± 0.42	3.41 ± 0.49	3.27 ± 0.39	4.50 ± 0.45	4.42 ± 0.65	3.41 ± 0.63	4.57 ± 0.47
Salinity (ppt)	3.1 ± 0.45	3.5 ± 0.45	3.8 ± 0.23	3.6 ± 0.09	3.88 ± 0.35	3.67 ± 0.71	3.65 ± 0.32	3.58 ± 0.46	4.78 ± 0.33	3.87 ± 0.35	4.12 ± 0.65	4.29 ± 0.43
Conductivity (µS/cm)	167 ± 10.8	189.5 ± 9.3	178.2 ± 6.5	145.2 ± 7.4	208.3 ± 6.2	200.5 ± 5.9	242.5 ± 9.4	202.6 ± 8.2	256. ± 12.5	276.2 ± 10.3	254.1 ± 9.7	239.4 ± 11.8

A, B, C = Fish farms; *D. Oxy* dissolved oxygen, *ppt* part per thousand, *Autu* autumn, *Win* winter, *Spr.* spring, *Sum* summer

Table 3 Prevalence, mean intensity and mean abundance of gill parasites in *Oreochromis niloticus* of the three fish farms

	Monogenea					Trichodina				
	IF/EF	N	P %	MI	MA	IF/EF	N	P %	MI	MA
Fish farm (A)										
Winter	1/30	1	3.33	100	3.33	6/30	22	20	366.67	73.34
Spring	8/30	10	26.67	125	33.33	13/30	37	43.33	284.62	123.34
Summer	6/30	8	20.00	133.33	26.67	8/30	31	26.67	387.5	103.34
Autumn	5/30	7	16.67	140	23.33	5/30	28	16.67	560	560
Mean	4.75/30	6.5	16.67	124.58	21.67	5	29.5	26.67	399.70	215.01
	Monogenea					Trichodina				
	IF/EF		P %	MI	MA	IF/EF	N	P %	MI	MA
Fish farm (B)										
Winter	0/30	0	0	0	0	0/30	0	0	0	0
Spring	2/30	3	6.67	150	10	3/30	14	10	466.67	46.67
Summer	3/30	3	10	100	10	4/30	17	13.33	425	56.67
Autumn	0/30	0	0	0	0	1/30	5	3.33	500	16.67
Mean	1.25	1.5	4.17	62.5	5	2/30	9	6.67	347.92	30.00
	Monogenea					Trichodina				
	IF/EF	N	P %	MI	MA	IF/EF	N	P %	MI	MA
Fish farm (C)										
Winter	24/30	91	80	379.17	303.33	**27/30**	554	**90**	2051.85	1846.67
Spring	23/30	89	76.67	386.96	296.67	30/30	547	100	1823.33	1823.33
Summer	30/30	173	100	576.67	576.67	30/30	483	100	1610	1610
Autumn	21/30	134	70	638.10	446.67	30/30	565	100	1883.33	1883.33
Mean	24.5	121.75	81.67**	495.23**	405.84**	29.25/30	537.25	**97.5****	1842.13**	1790.83**

A, B, C = Fish farms; *N* number of collected parasites, *IF* infected fish, *EF* examined fish, *P* prevalence, *MI* mean intensity, *MA* mean abundance, ** = high significant difference ($p < 0.01$)

81.67 %, mean intensity at 495.23 and mean abundance at 405.84 (Table 3). While the prevalence of trichodina on the gill of tilapia in fish farm (C) ranged from 90 to 100 %, with mean prevalence of 97.5 %, mean intensity at 1842.13 and mean abundance at 1790.83 (Table 3). The prevalence of monogenea on the skin of tilapia in fish farm (C) ranged from 56.67 to 76.67 %, with mean prevalence of 66.67 %, mean intensity at 443.68 and mean abundance at 249.16 (Table 4). While the prevalence of trichodina on the skin of tilapia in fish farm (C) were similar to the prevalence of trichodina on the gill, which ranged from 90 to 100 %, with mean prevalence of 97.5 %, mean intensity at 875.0 and mean abundance at 857.5 (Table 4).

Discussion

The investigations of this study were concentrated on the major ectoparasites (monogenean and trichodinids) on gills and skin of the Nile tilapia *O. niloticus* and their relations to water quality, pond management and seasonality of infection Tables 3 and 4. The results of this study showed a clear relationship between ectoparasites and water quality and with nutritional quality, i.e. fish farm (C) showed significantly higher ($p < 0.01$) means of prevalence, intensity and abundance of both monogenean and trichodinids on both gills and skin of the Nile tilapia *O. niloticus* in all seasons, followed by fish farm (A) then fish farm (B). The insufficient poor nutritional quality, little water exchange in addition to poor water quality with low dissolved oxygen, high ammonium-N, nitrite-N, Salinity, and conductivity which were significantly ($p < 0.01$) higher in fish farm (C) than fish farm (A) and fish farm (B) respectively, resulted in the high infection through out the year. Moraes and Martins (2004) indicated that the presence of ectoparasites is directly related to water quality and pond management. Other authors found a relationship between host, parasite and the environment (Buchmann and Lindestrom 2002). Xu et al. (2007) studied temperature and stress which lowered the immune response of the host and

Table 4 Prevalence, mean intensity and mean abundance of skin parasites in *Oreochromis niloticus* of the three fish farms

	Monogenea					Trichodina				
	IF/EF	N	P %	MI	MA	IF/EF	N	P %	MI	MA
Fish farm (A)										
Winter	0/30	0	0	0	0	3/30	8	100	266.67	26.67
Spring	4/30	5	13.33	125	16.67	8/30	11	26.67	137.5	36.67
Summer	3/30	3	10	100	10	6/30	14	20	233.33	46.67
Autumn	2/30	2	6.67	100	6.67	3/30	9	10	300	30
Mean	2.25/30	2	7.5	81.25	8.34	5	10.5	39.17	234.37	35.00
	Monogenea					Trichodina				
	IF/EF		P %	MI	MA	IF/EF	N	P %	MI	MA
Fish farm (B)										
Winter	0/30	0	0	0	0	0/30	0	0	0	0
Spring	0/30	0	0	0	0	2/30	7	6.67	350	23.33
Summer	1/30	1	3.33	100	3.33	3/30	8	10	266.67	26.67
Autumn	0/30	0	0	0	0	0/30	0	0	0	0
	0.25	0.25	0.83	25	0.83	1.25	3.75	4.17	154.17	12.5
	Monogenea					Trichodina				
	IF/EF	N	P %	MI	MA	IF/EF	N	P %	MI	MA
Fish farm (C)										
Winter	19/30	76	63.33	400	253.33	27/30	189	90	700	630
Spring	21/30	89	70	423.81	296.66	30/30	302	100	1006.67	1006.67
Summer	23/30	101	76.67	439.13	336.66	30/30	268	100	893.33	893.33
Autumn	17/30	87	56.67	511.76	290	30/30	270	100	900	900
Mean	20/30	88.25	66.67**	443.68**	294.16**	29.25/30	257.25	97.5**	875**	857.5**

A, B, C = Fish farms; *N* number of collected parasites, *IF* infected fish, *EF* examined fish, *P* prevalence, *MI* mean intensity, *MA* mean abundance, ** = high significant difference ($p < 0.01$)

resulted in unbalanced host/parasite/environment interaction, although temperature has no significant effect on the occurrence of ectoparasite when the water and nutritional qualities were maintained at a high level as shown by this study. The present study revealed no correlation between stocking density and parasite occurrence with the presence of high water and nutritional quality which was shown by the least infection in fish farm (B) in all seasons when compared to fish farm (C) (Tables 3, 4).

Seasonality effect on ectoparasite infestation showed some contradictory results. On one hand this study showed no significant effect of the seasons on parasite prevalence, intensity or abundance ($p < 0.05$) in all studied farms. Similar results obtained by Jerônimo et al. (2011), they found the monogenoidea present in fish ponds throughout the year. On the other hand (Hassan 1999) found some effect of seasonality on the prevalence of trichodina in the eastern province of Saudi Arabia where it was high in spring and winter and low in autumn and summer.

Poor water quality, poor management and poor nutritional qualities played an important role in parasite occurrence and infection as shown by this study. So, ectoparasites can be used as a bio-indicator of the environmental deterioration. It can be concluded that monogenean and trichodinids on the farmed Nile tilapia *O. niloticus* present in fish ponds that characterised by poor water and nutritional qualities which may affect immunity of the host, while temperature alone was probably, not the main causing factor of parasite infection of Nile tilapia in ponds. Further studies on how water and nutritional qualities affect the immune response of the fish to resist parasitism should be investigated.

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