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Effect of seasonal variations on performance and parasitic infestation of cultured fish in Fayoum governorate

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A field study was carried out in a fish farm to study the effect of seasonal variations during the production period on performance and parasitic infestation of cultured fish. Water samples were obtained to determine the Physio-chemical investigation of water in the examined farm to estimate temperature, dissolved oxygen, PH, ammonia, nitrite, nitrate, salinity, total alkalinity and total hardness. Fish samples were obtained for parasitological examination to detect external parasitic infestation.The results referred that an elevation of water temperature during summer months leading to slight increase of PH of water, while dissolved oxygen values decreased from 6.8±0.15 to 6.0±1.5 throughout the study period. The mean values of ammonia, nitrite and nitrate reach the maximum in July and August months (0.71±0.18, 0.20±0.07 and 3.1±0.07 mg/l respectively). In addition there was a slightly increase of the total alkalinity and total hardness at beginning of the study (37.8±3.0 and 147.0±5.0mg/l respectively) reached the maximum levels in the summer months (44.4±2.8 and 182.8±6.0 mg/l respectively). It can be noticed that the most prevalent ectoparasitic affecting cultured Tilapia are Trichodina,Monogenia and Epistylis. It can be noticed that, the average initial body weight of examined fish was 6.8±2.3 gm and reached 218.0±3.8 gm. at the end of experiment (210 days) with an average of daily weight gain 1.01 ±0.07 gm. From the aforementioned results, it can be concluded that special attention to Physio-chemical parameters of water fish ponds and regular inspection of fish parasitic infestation particularly during summer months obtained a good fish performance as well as high body weight gain and high survival percentage.

Aquaculture has been vigorously developed in recent years to achieve two major purposes food security and income generation; the vast majority of this is conducted in ponds (Okonji and Akolisa, 2005). The most important aspect of pond management is the maintenance of adequate environmental conditions for good growth .Tilapia niloticus are one of the most successful cultured fish in the world because of their fast growth, their efficiency to utilize the natural and supplemental feeds besides, they can tolerate a wide range of environmental conditions of the ponds (Yang *et al.,* 2003). Knowledge of water quality principles will help the aquaculturists in determining the potential of a body of aquaculture, improving environmental conditions in ponds and avoiding stress related disease (Azaza *et al.,* 2008). In practice, environmental conditions such as temperature, dissolved oxygen, alkalinity and nitrate are difficult to be controled, so they may be only monitored or maintained at tolerable levels, as opposed to optimal levels (Frei *et al.,* 2007).

On the other hand, parasitic infestations associated with farmed tilapia are useful indicators of quality and safety of fish for consumers (Kapetanovic *et al.,* 2005). Dontwi, (2004) recorded that the species of genus *Trichodina*, (*phylum Ciliophora*) and sub class monogene (*phylum Platy helminthes)* identified on the Nile Tilapia (*Orechromis niloticus*) are among the commonest ectoparasites which could cause a major health problem in future for the fishing industry. While Amoako (2006); Herrison *et al.,* (2007) stated that there were no strong relationships between ectoparasite prevalence and intensity and the physico-chemical properties and the management practices on the farms.

Accordingly, the main goal of this study was carried out to show effect of seasonal variations on fish performance and parasitic infestation through: Physiochemical analysis of water pond, parasitological investigation of fish and fish performance as well as growth rate and survival percentage.

Materials and methods

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A field study was carried out in a fish farm belonging to Faculty of Agriculture, Fayoum University from April 2006 till end of October 2007 to study the effect of seasonal variations during the production period on performance and parasitic infestation of cultured fish.

The farm was located in Demo- province and contain several earthen ponds, each one acre. The ponds received freshwater from Yousef canal. The fingerlings of average weight 6.8±2.3 gm were stocked at rate 12.0±2.0/ m^3 and fed on commercial pellets ration contain 25 % protein with premix (fish fed 3% - 5% of body weight daily). Water exchange was done 3 times per week. No fertilizer was added to the ponds.

Samples collection.

Water samples. 40 water samples were taken monthly from both water inlets and fish ponds in the examined farm throughout the production period. Water samples were obtained from three different sites, at depth of 15- 20 cm below the water surface of each pond in sterile and colorless glass Stoppard bottle of 1 liter capacity. The labeled bottles were dispatched at 5°C to the Department of Fish Diseases in Animal Health Research Institute – Dokki with minimum delayed to determine the Physio-chemical investigation of water in the examined farm by methods as described by APHA, (1998). The following parameters were estimated in water samples**;** temperature, dissolved oxygen, PH, ammonia, nitrite, nitrate, salinity, total alkalinity and total hardness.

Temperature (°C). It was measured daily in different sites of farm using floating ordinary thermometer.

Dissolved oxygen (mg/l). It was measured daily in different sites of farm using Oxygen meter **(**model 946-50, Coleparmer instrument, U.S.A).

pH value. It was determined by digital PH meter model 25025-Jenway- Germany.

Ammonia (UIA-N). It was determined by ammonia kits at wave length 676 nm applied in Colorimeter.

Nitrite and nitrate (NO_2-N & NO_3-N). They were determined by nitrite and nitrate kits (No. 0.25326 and 0.25325) with wave lengths of (545, 410) applied in Colorimeter.

Total alkalinity (mg/l as $CaCO_3$). It was determined by total alkalinity test kits (No. H13811 – Hanna instrument) analysis method acid titration using phenol phethaline and promo phenol blue.

Salinity (mg/l). It was determined by hand refractometer- (Cole- Parmer instrument Co- Atago-60648- Chicago- USA).

Total hardness (mg/l as $CaCO_3$). It was determined by total hardness test kits (No.H1 3812 - Hanna instrument), analysis method EDETA titration.

Fish samples. A total of 100 Tilapia nilotica fish were collected from the examined farms. A cast net was used to collect five fishes randomly selected from a fish farm. The fish transferred alive in large plastic containers filled with the original farm water, supplied with battery air pump. Collected samples were transferred with a minimum delay to the laboratory; where samples were kept in glass aquaria of 100x50 x30 cm for parasitic investigation.

Parasitological investigation of fish. Parasitological examination for detection of external parasitic infestation was carried out according to method of Plumb and Bowser, (1983). The gill and skin mucus of the collected fish were examined as follows:

Gill. A section of the first gill lamellae after the operculum on the left side was cut using dissecting sissors. The rest of the lamellae and the gill arch were discarded. The specimen was thinly spread on a slide and a drop of distilled water was added. Specimen was then covered with a cover slide and examined under the microscope with a magnification of 60 X for parasites (Monogeneans and Trichodina sp.).The same procedure was repeated for all fish samples to ensure consistency in the results.

Skin mucus. The body mucus from the caudal part (upper dorsal area between the anal fin and the caudal fin) of the fish was scraped with cover glass. Scraping was carried out carefully to avoid the scales in order to increase the visibility of small protozoan's.Mucus was then placed on a glass slide with a drop of distilled water, then cover glass. The specimen was then examined under the microscope for ectoparasites. Ectoparasites found on the specimen were identified and their number was counted. Examination of fish gills and mucus for parasites was done at the same day of sampling where some ectoparasites may either leave or die after the host is dead. The procedure was repeated for all fish samples.

Fish performance. The fish samples were weighted every month throughout the production period to calculate the following measures.

Body weight gain of examined fish. Weight gain % = 100 (final weight (g) – initial weight

(g) / initial weight (g)) According to Likongwe *et al.,* (1996).

Survival rate of examined fish. Survival % = (Nf / Ni) x 100. Where Nf and Ni are the number of fish harvested and stocked respectively, according to method done by (Hargreaves and Semra, 2001).

Statistical analysis. Results were statistically analyzed by the use of one way ANOVA (F test and T test) according to Snedecor and Cochran, (1989).

Results and discussion

The mean values of physico-chemical parameters of water in ponds of fish farm throughout the study period in Table (1) referred that an elevation of water temperature during Summer months (June to August) leading to slightly increased of PH of water where it changed from 8.7±0.6 to 7.1±0.01, while dissolved oxygen values decreased from 6.8±0.15 to 6.0±1.5 throughout the study period. At the beginning of study at April the mean value of ammonia level 0.23± 0.1 mg/l and reach to the maximum value in July time, 0.71± 0.18 mg/l.Moreover nitrite and nitrate values at beginning of study (0.06±0.02 and 0.6± 0.05 mg/l respectively) reached to maximum levels at August month (0.20±0.07 and 3.1±0.07 mg/l respectively). In addition there was a slightly increase of the total alkalinity and total hardness at the beginning of study (37.8±3.0 and 147.0±5.0mg/l respectively) till reached to the maximum levels in the summer months (44.4±2.8 and 182.8±6.0 mg/l respectively). This changes of these parameters will be reflect on the salinity of water, where mean value of salinity at start of study was 34.6±2.3 and reached to 41.5±2.6 mg/l at the end of experiment. This results may be attributed to further degradation of organic waste and decreased of dissolved oxygen, these findings are supported with the results that obtained by Uddin *et al.,* (1990); Boyd, (1998) who stated that the temperature is the most important factors affecting level of dissolved oxygen in fish ponds and subsequently metabolic rates of aquatic organisms.

From Table (2) it can be noticed that the most prevalent ectoparasitic affecting cultured Tilapia are Trichodina, Monogenia and Epistylis. In this study Trichodina parasites incidence at the start of study at April was 2.6±1.4 and slightly increased throughout the months of study till reached to the highest value 25.0±4.0 at August month. This result agree with that obtained by Badran *et al.,* (1996); Mohamed (1996) who mentioned that the seasonal occurrence of the skin parasites among three types Tilapia was high in summer than other seasons, in contrast Avoult and Shell, (1994); Abd El Khalek, (1998) they noticed that the higher incidence of Trichodina infestation wsa observed in winter season among all investigated fish species. Monogenia ectoparsit was undetected at beginning of study but reach to maximum level 26.0±2.8 at July month. Dontwi, (2004) mentioned that Tichodina and Monogenia are the most common ciliate present on the skin and gills of pond-reared fish and cause a major health problems in fish industry.Morever Epistylis undetected at the first two months of study (April and May), reached to the highest level 20.4±2.4 at August month. Hussein, (1992) noticed that isolated Epistylis from Tilapia spp.with an infestation rate of 0.9% only occurred during winter season. In addition the mixed protozoa was highest at July and August months (20.0±1.1 and 25.1±4.1 respectively), this result agreed with (Badran *et al.,* 1996) recorded that the high prevalence of different skin ectoparsites among Tilapia spp. was appeared at the months of high water temperature.

Table (3) showed fish performance (body weight gain and survival %) in relation with parasitic infestation in examined fish farm throughout the period of study. It can be noticed that, the average initial body weight of examined fish was 6.8±2.3 gm. and reached to 218.0±3.8 gm. at the end of experiment (210 days) with an average of daily weight gain 1.01 ±0.07 gm. Akram and Hesham, (2007); Azaza *et al.,* (2008) pointed out two possible explanations for reduced growth caused by ammonia exposure includes reduce appetite or digestibility of consumed feed.

In addition total percentage of parasitic infestation in the examined fish throughout the experimental period reached to 10.4±2.6 in average, this lead to decrease in body weight gain and consequently a mortality in this farm reached to 13 %. Wrighley *et al.,* (1988) reported that high ammonia and low dissolved oxygen concentration during the summer and spring were the major factors responsible for mortality in sewage-fed fish ponds.Moreovere, Naylor *et al.,* (2000); Amoako (2006); Herrison *et al.,* (2007) recorded that there were no strong relationships between ectoparasites prevalence and intensity and physico-chemical properties and the management practices on the fish farm.

Table (1): The mean values of physio-chemical parameters of water in fish farm throughout the study period.

Water Parameters	Months						
	April	May	June	July	August	September	October
Temperature (°C)	26.7±1.5	28.33±1.3*	30.8±1.4*	33.7±1.6**	33.9±1.8**	32.0±1.2**	30.7±1.4*
Dissolved oxygen (mg/l)	6.8±0.15	6.0±0.16	6.2±0.03	6.1±0.0	6.0±0.15	6.2±0.11	6.5±0.28
pH	7.5±0.14	8.2±0.14*	8.7±0.06*	7.7±0.06*	7.1±0.0	7.3±0.01	7.3±0.1
NH_3 - N (mg/l)	0.23±0.1	0.35±0.1	0.52±0.1*	0.71±0.18**	0.64±0.11**	0.50±0.1*	0.35±0.18
NO_2 - N (mg/l)	0.06±0.02**	0.1±0.07*	0.15±0.07**	0.20±0.06**	0.20±0.07**	0.15±0.06*	0.13±0.06*
NO_3 - N (mg /l)	0.60±0.05	1.27±0.7	1.90±0.5*	2.7±0.4**	3.01±0.7**	3.1±0.6**	2.76±0.6**
Total Alkalinity (mg/l)	37.8±3.0	41.4±2.7*	42.7±3.1**	43.5±2.0**	43.8±3.0**	44.4±2.8**	45.0±3.0**
Total hardness (mg/l)	147.0±5.0	158.7±5.0*	180.0±3.0**	168.0±4.0*	177.0±5.0**	182.8±6.0**	203.5±5.4**
Salinity (mg/l)	34.6±2.3	37.1±2.1*	38.0±2.2**	37.8±2.3*	38.1±21**	38.8±2.0**	41.5±2.6**

Results are expressed as means± S.E.
** Highly significant at P< 0.05
* Significant at P< 0.01

Table: (2): The mean values of parasitic infestation (%) of fish in farm throughout the study period.

Parasitic Findings	Month							
	April	May	June	July	August	September	Octobers	% of parasites
Trichodina	2.6±1.4	4.2±1.1	9.2±1.0*	20.0±3.0**	25.0±4.0**	9.2±1.1*	UD	28.6
Monogenia	UD	8.7±2.0	12.3±2.0*	26.0±2.8**	16.0±2.0**	7.5±2.1	UD	25.7
Epistylis	UD	UD	15.3±2.7*	19.3±3.1**	20.4±2.4**	8.0±1.5	UD	21.7
Mixed	UD	3.8±1.1	7.9±1.8*	20.0±1.1**	25.1±4.1**	14.3±2.6*	10.7±3.1*	23.9
Total	2.6±1.4	16.7±1.2	44.7±2.3	85.3±2.8**	86.5±2.5**	39.0±1.6	10.7±3.1	

UD = undetected
Results are expressed as means ±S.E.
** Highly significant at P< 0.05
* Significant at P< 0.01

Frei *et al.,* (2007) noticed that a high growth rate were obtained in ponds with warm water more than 21^{0}C and pond depth 1 to 2 m with significant increase of weight gain (P>0.001), feed conversion and decreased mortality (P>0.001) comparing with fish reared under temperature below 21 ^{0}C.

Table (3): Fish performance (weight gain and survival %) in relation to parasitic infestation in examined fish farm through the study period.

Parameters	Values (means ± S.E.)
Initial body weight(g)	6.8 ± 2.3
Final body weight (g)	218.0 ± 3.8
Daily weight gain(g)	1.01 ± 0.07
Parasitic infestation (%)	10.4 ± 2.6

From the aforementioned results, it can be concluded that special attention to Physio-chemical parameters of water fish ponds and regular inspection of fish parasitic infestation particularly during summer months obtained a good fish performance as well as high body weight gain and high survival percentage in fish farm.

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تأثير التغيرات الموسمية على كفاءة ومعدل الإصابة الطفيلية فى مزارع الأسماك بمحافظة الفيوم

أجريت هذه الدراسة على مزارع الأسماك لإستبيان تأثير التغير ات الموسمية خلال فترة الإنتاج على كفاءة الأسماك والإصابة بالطفيليات فى مزارع الأسماك. أخذت عينات للمياه التى تعيش فيها الأسماك وذلك لتقدير الخصائص الفيزيوكيميائية متمثلة فى درجة الحرارة , الأكسجين الذائب , درجة تركيز أيون الهيدروجين والأمونيا والنترات والنيتريت , درجة الملوحة , درجة القلوية والعسر الكلى للمياه. تم أخذ عينات من الأسماك لإستكشاف الطفيليات الخارجية.

أظهرت النتائج ان إرتفاع درجة الحرارة فى موسم الصيف كان مصحوباً بإرتفاع بسيط فى تركيز أيون الهيدروجين وتقليل نسبة الأكسجين الذائب كما تم ملاحظة زيادة فى معدلات الإصابة بالطفيليات الخارجية للأسماك متمثلة فى تريكودينا , مونوجينا و ابستيليز لذا يجب الأخذ فى الإعتبار الإهتمام الكافى بالخصائص الفيزيوكيميائية لمياه مزارع الأسماك وكذلك الإصابة بالطفيليات الخارجية وخاصة فى فصل الصيف للمساعدة على زيادة كفاءة الأسماك والمتمثلة فى معدلات نمو وبقاء هذه الأسماك.