Trichodiniiasis in Farmed Freshwater Tilapia in Eastern Saudi Arabia

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ABSTRACT. The present study is aimed at screening for the presence of Trichodina sp. among Tilapia spp. (Oreochromis niloticus and Oreochromis aureus) collected from various fish farms in the eastern Province of Saudi Arabia during January, 1995-May, 1997. Out of 675 fishes collected only 335, (49.6%) were infested with Trichodina. The highest prevalence was observed in the spring and winter followed by autumn and summer. In general, the intensity of infection was low except in cases where outbreaks of Trichodiniiasis endangered the survival of fish in some ponds. In light infestation Trichodina is usually present on gills, fins and skin of apparently healthy fish. Clinical signs of Trichodiniiasis only appear on fish with heavy infections and cases of moderate ones that are usually exposed to one or more stress factors including, rough handling during transportation from ponds, overcrowdness, malnutrition, high of free ammonia and low of oxygen concentration. Clinical signs of Trichodiniiasis in fish are sluggish movement, loss of appetite, black colouration, necrosis and ulcer on different parts of the body, detached scales and excessive accumulation of mucous in gill pouches. The most obvious histopathological changes in diseased fish were sloughing of the epidermal layer, aggregation of leucocytes and melanine-carrying cells (between the dermis and hypodermis) and proliferative changes including hyperplasia and hypertrophy of the epithelial lining cells of gill filaments which resulted in fusion of secondary lamellae. Control of Trichodiniiasis, has been achieved by formalin bath treatment at a concentration of 250 ppm for one hour.

Introduction

The concept of aquaculture development as a potential source of food supply is receiving much attention in the Kingdom of Saudi Arabia. This has resulted in rapid growth in fish farming practice.

The intensification of such fish culturing creates disease problems that originate from overcrowdness (Sarig, 1968a) or deteriorating water quality such as unsuitable water temperature (Dujin, 1973), pH (Kugel et al., 1990), carbon dioxide and free ammonia concentrations.
It is usually known that external parasites constitute the largest group of pathogenic organisms in warmwater fish (Snieszko and Axelrod, 1971). The majority of fish ectoparasitic protozoa are commensals but some of them may produce serious diseases and mortality especially in fry and fingerlings. The taxonomy and pathological effects of these parasites have been dealt with by Lom and Hoffman (1964), Wellborn (1967) and Hoffman (1978), Amlacher (1970), Molnar (1971), Kennedy (1974) and Van As and Linda Basson (1983).

Parasitic protozoa have a direct life cycle that enables them to spread rapidly and widely in their hosts (Kudo, 1966). Such rapid growth and multiplication of these parasites greatly increase their rate of infestation among fish causing mass mortality.

*Trichodina* are a very common ectoparasites which in most cases are pathogenic to both freshwater and marine fish (Wellborn, 1967). Dogiel (1961) reported that trichodiniasis is caused by *Trichodina* spp.; the infection being stimulated by the high density of fish in ponds. Under such conditions, it may be an epizootic. In cases of stress, several species of trichodina may become pathogenic interfering with feeding and respiration of small fish (Sarig, 1968b and Ahmed, 1976).

The lesions mostly induced by this parasite are hyperplasia and necrosis of the epidermal cells. These cells are usually subjected to severe attacks by parasites. This results in cellular growth and excess mucus production (Ahmed, 1976). Many authors have observed a complete destruction of gill epithelium in similar cases (Paperna, 1980; McArdle, 1984; and Eisa et al., 1985).

For the control of Trichodiniasis, formalin is recommended by many authors that have experimented with different concentrations ranging between 166 to 250 ppm applied directly in short-term bath (Amlacher, 1970; Klinke, 1973; Paperna, 1980; and McArdle, 1984).

The present work was aimed to achieve the following objectives: First, to investigate the incidence of *Trichodina* in freshwater *Tilapia* (*Oreochromis niloticus* and *Oreochromis aureus*) in different farms in the eastern Province of Saudi Arabia. Secondly, to examine and evaluate the magnitude of injury that induced by this parasite in infected tissues and organs of the fish. Thirdly, to test efficacy of formalin in controlling the parasite.

**Material and Methods**

In the present investigation, about 675 tilapias were collected regularly from various ponds of fry, fingerlings, growing and brood stock, during a fish health survey of different fish farms in the eastern Province of Saudi Arabia and also during emergency cases where some fish mortalities were observed during the period of January, 1995-May, 1997.

After observation of fish behaviour in various ponds, collected samples were transported (alive) to the laboratory of Fisheries Research Center, Al-Qateef, in large plastic bags which were aerated upon arrived to the laboratory, fish were maintained in aerated
Skin fins and gills smears of these fish were made and carefully searched for *Trichodina* sp. The severity of infection with *Trichodina* sp. was estimated on an arbitrary scale using ordinary microscope under a 10× objective lens where no parasites were observed (–), low infection with single parasite in several fields of vision (+), medium infection with 2 to 5 parasites per field of vision (++) and severe infection with more parasites per field of vision (+++). After examining parasites alive, they were fixed to microscope slides with methyl alcohol then stained with Giemsa according to Lucky (1977). Gills and skin specimens from clinically infested fish were fixed in phosphate buffered formalin, trimmed and prepared for histopathological examination. Specimens were embedded in paraffin wax and sectioned using a rotary microtome at 5-7 µm thickness. Specimens were stained with haematoxylin and eosin (Hibiya, 1982).

During outbreaks of *Trichodiniasis* among fish in some ponds, dissolved oxygen concentrations were measured with Orion model 850 oxygen meter and ammonia (as ammonia-nitrogen) was determined by the Nessler method (Hach model DR/2000).

Clinically infested fish in ponds were treated by addition of formalin at a concentration of 250 ppm for one hour (Klinke and Elkan, 1965). Treated fish were checked after 24 hours.

**Results**

**Identification of the parasite**

*Trichodina* were recorded from the body surface, fins and gills of *Tilapia*. In fresh unstained preparation, the parasite is very motile and appears as a circular or bell-shaped ciliated organism. The adhesive disc (saucer-shaped), several circular rows of cilia and a circle of more centrally lying hooklets could be easily seen in preparations stained with Giem’s stain, Fig. 1.

**Epizootology and clinical picture of the infection**

Out of 675 fish, 335 were found infested with *Trichodina* (49.6% infestation). Data indicate that the highest incidence of infestation was found in growing fish (61.11%) followed by fingerling (54.28%), Brood stock (46.87%) and lastly fry (34.31%). The number of fish examined were 180, 175, 160 and 160 for each age group, respectively.

The highest infestation with *Trichodina* sp. was found in spring (62.9%) followed by winter (56.25%) then Autumn (41.37%) while the lowest infestation rate was in summer (35%). A picture of heavily infected skin is shown in Fig. 2.

As indicated in the present study, the intensity of infection with *Trichodina* sp. was generally low except few cases were fish mortalities have been observed in some ponds. In light infestation, *Trichodina* sp. are usually present in small numbers of skin, fins and
Fig. 1. *Trichodina* sp. with peripheral adhesive disc followed by several circles of cilia and a central circle of hooklets (Giemsa, × 400).

Fig. 2. Tilapia skin: showing a heavy infection by *Trichodina* sp. (Giemsa, × 100).
gills of the infected fish and no clinical signs can be ascribed. On the other hand most clinical signs and mortalities in some ponds were noticed in fish with heavy infections and some cases of moderate ones due to exposure to one or several stress factors. These factors may include, rough handling during transportation, overcrowdness, malnutrition, high free ammonia (ranged between 0.8-2.16 mg/l) as well as low dissolved oxygen (with average 1.4 mg/l in clinically infected ponds).

Clinical signs and postmortem examination revealed that diseased fish showed sluggish movement, loss of appetite, emaciation, loss of condition with larger head and darker skin than normal. Some infected fish showed detached scales with pale skin patches and more slimy skin. Erosion and ulcer on different parts of the body, blood spots at the base of fins as well as laceration of membranous parts and sloughing of the free portation of them were also observed in some infected fish. On the other hand excessive accumulation of mucous in the gill pouches and around gill filaments were frequently noticed in these infected fish. The gill filaments appeared hypraemic and swollen in some cases and pale in others. Signs of asphyxia including surfacing of fish, gasping of air bubbles on the surface of water were also observed in heavily infested fish. Finally they lost their normal swimming behaviour and died.

**Histopathology**

The skin of fish infected with *Trichodina* species showed, sloughing of the epidermal layer and the remained dermis was oedematous and infiltrated with leucocytes and melanine-carrying cells which aggregate between the muscle layer (Fig. 3).

On the other hand, the epithelial lining cells of the gill filaments showed, proliferative changes, including, hyperplasia and hypertrophy. In most cases, the epithelial proliferation of the lamellae started from their apices and extended towards the basal portations. Sometimes, those proliferative changes extend to other lamellae where one, two, or three lamellae appeared adherent to each other. In some fish, epithelial proliferation was extensive leading to fusion of secondary lamellae (Fig. 4).

**Therapeutic control**

After 24 hour from the treatment with formalin (250 ppm), parasitological examination revealed that the *Trichodina* sp. were completely eradicated and most fish regained their normal feeding response, mortality ceased, and fish began to appear healthy.

**Discussion**

Parasitic infestation of cultured fish in tropical and subtropical countries represents a serious problem for aquaculture due to severe economical losses either as directly or indirectly (Roberts, 1978).

The data obtained from present study indicate that the *Tilapia* spp. have a variety of clinical and post mortem changes from infection with *Trichodina* sp. *Trichodina* sp. are commensals parasites on fish and have been reported in *Tilapia* (Abu El-Wafa, 1988; El-Khatib, 1989; and Hassan, 1992).
Fig. 3. Skin section revealing loss of epidermis, disarrangement of collagen bundles and leucocytic infiltration of dermis with aggregation of melanine-carrying cells (H & E, $\times 250$).
Fig. 4. Tilapia gills showing hyperplasia of interlamellar epithelium and hypertrophy of some secondary lamellae (H & E, × 250).
It is also apparent in the present study that *Trichodina* spp. prevail on skin and gills of *Tilapia* spp. Contrary to Lom (1962), who reported that the parasite occur only on the skin in the fresh water, and on the gills in the marine forms. On the other hand, the present findings confirm those of Snieszko and Axelrod (1971) in which they mentioned that *Trichodina* spp. occur on the gills and skin in numbers that could obscure the normal structure of the epithelium.

The incidence of infestation with *Trichodina* sp. reached 49.6%. Such results are nearly similar with that recorded by Okaeme *et al.*, 1988 (50%) in cultured *Tilapia* spp. in Nigeria. On the other hand higher rate of infestation of *Tilapia* spp. with the same parasite was observed by Abu El-Wafa (1988) who recorded an infestation on 66% in Egypt. However, lower results were obtained by El-Khatib, 1989 (30%) and Hassan, 1992 (12.5%). The present difference in the prevalence of infestation of the examined fishes with *Trichodina* spp., from those previous workers, could be attributed to the different environmental conditions during the period of the present investigation and different locality.

*Tilapia* spp. of all ages and sizes, were susceptible to infestation with *Trichodina* sp. The highest incidence of infestation was found in growing fish (66.6%) followed by fingerling (57.1%), then brood stock (50%) and lastly fry (34.3%). The present result conform to those of Paperna and Thurston (1968) who reported that *Tilapia* spp. of all ages and sizes were susceptible to such parasitic infection throughout the year. It is worthy to mention that infestation with *Trichodina* sp. varies between ages and sizes of *Tilapia* spp. and can be attributed to overcrowdness and consequently changes to water quality in ponds of growing and fingerling fish, compared with those of broods stock or fry.

Regarding the seasonal incidence, *Trichodina* infection was prevalent throughout the year with maximum rate of infestation during spring season (62.9%), followed by winter (56.25%), then autumn (41.37%) and was lowest in summer (35%). The results agree with the findings of McArdle (1984), Abu El-Wafa (1988) and El-Khatib (1989) who reported that, Trichodiniasis was prevalent all over the year with maximum rate of infestation during spring and winter.

It is also apparent in the present study that the intensity of infestation with *Trichodina* sp. was generally low, excepting few cases where mass mortalities have been reported in some ponds. In light infestation, fish do not show any signs of disease. However most clinical signs and mortalities in some ponds were noticed in fish with heavy infection. Mortalities in moderated infected fish is usually associated with one or more of stress factors including, rough handling, overcrowdness, malnutrition, high free ammonia (0.8-2.16 mg/l) as well as low oxygen (1.4 mg/l). *Trichodina* is an opportunistic parasite which become pathogenic under stress full conditions (Ahmed, 1976; Paperna, 1980; McArdle, 1984 and Eisa *et al.*, 1985). On the other hand, Abdel Meguide (1989) reported that *Trichodina* sp. is a true and permanent parasite which was noticed to bring about marked mortalities among newly-hatched grass carp.

The common lesions observed in the present study were in the form of black colouration, sloughing of scales with pale skin patches, laceration of membranous parts of fins
and sometimes sloughing of free portion of them, erosion and ulcer in different parts of the body were also observed and reported. These lesions are common in trichodina infection (Brown and Gratzek, 1980; McArdle, 1984; El-Khatib, 1989; and Hassan, 1992). In addition to these lesions, excessive accumulation of mucus on the skin and gills was seen on infected fish. The massive production of mucus in case of Trichodiniasis infection is regarded as a defence mechanism to eliminate the parasite or dilute its irritating effects (Rogers and Gains, 1975).

The results of histopathological changes in skin and gills of *Tilapia* infested with *Trichodina* sp. revealed sloughing of the epidermal layer and the remaining dermis was oedematous and infiltrated with leucocytes and melanine carrying cells which aggregate between the muscle layer and hypodermis forming a thick blackish band. This last finding may explain why the heavily infected fish had acquired characteristic dark colouration.

In addition to the above listed lesions, the epithelial lining cells of the secondary lamellae showed, proliferative changes, including, hyperplasia and hypertrophy resulting in their fusion. This finding may interpret the behaviour of fish, heavily infested with *Trichodina* sp., exhibiting distinct signs of respiratory disfunction.

With regard to parasitic control in the present study, inspection of the parasitised fish (exposed to 250 ppm of commercial formalin, for one hour and examined after 24 hours) indicated that fish were free of the parasite. Mortality ceased and formalin-treated fish appeared very healthy. Formalin is known to control ectoparasites in fish (Ahmed, 1976).

In conclusion, present study emphasized the importance of keeping good husbandry practice and favorable water quality parameters for successful rearing of fish. In case of outbreak of trichodiniasis, formalin is an effective therapeutic agent.

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**References**


مرض الترايكدندينياسس في أسماك بلطي المياه العذبة المستزرعة

بالمنطقة الشرقية من المملكة العربية السعودية

محمد عبد العزيز حسن حسن

مركز أبحاث الثروة السمكية بالقطيف - المملكة العربية السعودية

المستعرض. استهدفت هذه الدراسة معرفة مدى تواجد طفيل
الترابيكودينا في أسماك بلطي البطني المستزرعة بالمنطقة الشرقية
من المملكة العربية السعودية خلال الفترة من يناير 1995 إلى مايو
1997. هذه وقد أثبتت النتائج أن 9,49% من الأسماك التي تم فحصها
قصة بهsilium الترايبكوندينيا وقد سجلت أعلى نسبة إصابة في فصل الربيع
والشتاء على التوالي بينما كانت أقل نسبة للإصابة في فصل الصيف.
وعامة فإن هذه الإصابة بهذا المرض كانت سببية فيما عدا بعض الحالات
بعض الأحواض التي كانت مصحوبة ببعض الظروف لسمك البلطي
المستزرع فيها. ففي الإصابة البسيطة تتواجد أعداد قليلة من طفيل
الترابيكودينا على جلد، زعانف وخياشيم الأسماك التي تبدو بحالة
صحية جيدة. أما أعراض مرض الترايكدندينياسس فلا تظهر إلا في
الإصابة الشديدة وبعض الحالات من الإصابات المتواضعة والتي غالبًا ما
تتعرض فيها الأسماك المصابية لعامل أو أكثر من عوامل الإجهاد مثل:
العوامل المائية للأسماك أثناء عملية التنقل من حوض لآخر، زيادة
الكثافة، سوء التغذية، إرتفاع في مستوى الأمونيا الحرة أو نقص في
مستوى الأكسجين. ومن أهم الأعراض الظاهرة لمرض
الترابيكودينياسس: الحركة البطيئة، فقدان الشهية، تساعد القشر، دكاء
في لون الأسماك المصابية، وجود تأكيل وترتر في الطبقة السطحية من
الغشاء الطلائي للجلد في مناطق مختلفة من الجسم. هذا بالإضافة إلى
ترامك المخاط على الغطاء الخيشوسي للأسماك المصابية. وفي حالة
الإصابات الشديدة تظهر حالات النفوق بين الأسماك المصابية. وعن أدمم
التغيرات البالغة في الأسماك المرضية: تساقط لطبقة البشرة الجلدية،
تجمع كرات الدم البيضاء والخلايا الصبغية الكبيرة السوداء بين أدمم
الجلد وما تحت الأدمة. كما يظهر زيادة تضخم وتكاثر غزير للمخلايا الطلائية المبطنة للصفائح الخيشومية الثانوية والتي تؤدي إلى التصاقها لتظهر كوحدة تركيبية واحدة. وللفضاء على طفيل السيفاكودينا بالأحواض المصابة فقد تم بنجاح استخدام الفورمألين بتركيز ۵۰٪ جزء في المليون كحمام مائي لمدة ساعة.