Chronicle of Aquatic Science
Open Access Peer Reviewed Journal
Vol. 1, Issue 4
https://chronicleofaquaticscience.in/

Popular Article
Chandra et al. (2023)
Manuscript Id: **CoAS_V1IS4_02**

OPEN ACCESS

Therapeutants used for Protozoan Parasitic Diseases in Fishes

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How to cite this article:

Chandra, I., Verma, D. K., Maurya, N. K. and Dixit, A. 2023. Therapeutants used for Protozoan Parasitic Diseases in Fishes. *Chronicle of Aquatic Science* 1(4): 15-23.

ABSTRACT

Globally, finfish aquaculture is constantly growing in both freshwater and marine environments, and there is clear potential for a significant further growth. When infection intensities in the enclosed aquaculture environment reach high levels, they may then produce disease. The difficulty posed by parasites is further exacerbated by the possibility of parasite transfer from aquaculture operations to wild fish stocks. Veterinarians are responsible for treatment using the prescribed therapeutant on the fish farm and are also involved with the aquaculture operator to ensure that the treated fish or crustaceans are safe for human consumption. The current work describes integrated control techniques, health management and treatment protocols for diseases brought on by protozoan parasites in more detail and promote their usage.

KEYWORDS

Aquaculture, Control, Disease, Fish and Parasite

Introduction

Therapeutants are chemicals that can be utilized in aquaculture or fish farming operations to maintain the health of aquatic animals (fish or crustaceans) as they are being raised. In both hatcheries and grow-out farms, disease brought on by parasitic, fungal, bacterial, and viral infections are growing more common. India has recently had three major disease epidemics. The dreaded epizootic ulcerative syndrome (EUS) in freshwater cultured species was the first to hit. Yellowhead virus illness and whitespot virus disease in prawn farms came after this. The country's aquaculture business suffered serious setbacks as a result of the introduction of these illnesses, necessitating the usage of therapeutic agents in both the freshwater carp and prawn industries (Pathak *et. al.*, 2000).

Health problems in aquaculture systems

Aquaculture, which includes both freshwater and marine production, has experienced one of the fastest growth rates in animal protein production over the last few decades and is predicted to continue at the same rate over the next ten years. One of the most significant obstacles if this production goal is to be met is disease control. Apart from viral, bacterial, fungal, and metazoan diseases, protozoan parasites have been shown to have an impact on fish health (Buchmann K., 2015). The majority of fish parasites need to be identified under a microscope. The diagnosis is challenging and improbable without a microscope or if the individual using it has never used one before. Fishermen that are successful learn by doing. Newcomers to the profession should attend brief training courses to understand the principles of diagnostic processes and how to use a microscope to find parasites (Klinger and Floyd,1998).

Protozoan parasites

One of the biggest risks to fish health is protozoan parasites, which spread disease in both farmed and wild fish populations (Buchmann, K., 2015). Fish populations can quickly become infected by parasitic protozoa, especially those with direct lifecycles and broad host specificity. Invasion by parasites can slow growth, result in weight loss, and stop reproductive processes. A serious disease can cause severe fish stock damage and current mortality. Other protozoa enter internal organs like the gut, while some are ectoparasites that live on skin, fins, or gills. Protozoan parasite prevalence, intensity, histology, taxonomy, and systematic classification have all been studied in a few publications, mostly on ectoparasitic protozoa (Barzegar *et. al.*,2023). Protozoan parasites divided in to three groups: Ciliates, Flagellates, and Dinoflagellates.

Ciliates parasites

Most of the protozoans that aquarists find are ciliates. These organisms have tiny, ciliated structures that are employed for both locomotion and/or feeding. Ciliates have a simple life cycle and are frequent pond dwellers. Most species do not appear to bother host fish until their numbers become excessive. Ciliates are easily spread from tank to tank by nets, hoses, or caretakers' damp hands. In marine and brackish water are the most common ciliates parasite *Ichthyophthirius spp*. in freshwater and *Cryptocaryon spp.* Others ciliates parasites are *Chilodonella sp. Trichodina sp. Apiosoma sp. Epistylis sp. Brookynella* sp. *Tetrahymena* sp. *Uronema* sp, *Vorticella sp. Zoothamnium* sp. (Klinger and Floyd, 1998).

Flagellate parasites:

They are identified by one or more flagella that give the parasite a whip-like or jerky motion when it moves. Flagellates can typically be distinguished by their tiny size when their movement is examined at 20 to 400 times magnification under a microscope. Common flagellates parasite infection in fish are *Hexamita, Spironucleus. Icthyobodo. Cryptobia. Trypanosoma*. *Piscinoodinium* (Klinger and Floyd, 1998).

Application of therapeutants in protozoan parasitic disease in fishes

Therapeutants are substances or compounds that are used to cure various diseases, particularly those caused by protozoan parasites. Protozoan parasites are single-celled creatures that can cause serious health problems in humans, animals, and plants. Here are some examples of therapeutant applications in the treatment of protozoan parasite infections. Freshwater fish are commonly infected with parasites such as single-celled protozoa, multicellular trematodes, crustaceans, and arthropods (Woo, 2006). Several commercially available veterinary drugs such as Nuvan, Butox Vet, Cliner, Ectodel (2.8%), Emamectin Benzoate (EB), Hitek Powder, Paracure-IV are commonly used in aquaculture to combat parasitic infestations. Besides that, other common therapeutants used in aquaculture are Formalin, Chloramine–T, Magnesium sulphate, Copper sulphate, Potassium Permanganate, Sodium chloride, Hydrogen Peroxide.

Table 1. Application of therapeutants for protozoan parasitic diseases in fish with dosages and treatment protocol

Protozoan parasitic diseases	Causative agents:	Clinical signs	Target organs:	Doses and Treatment protocols
Fresh water White spot disease or Ich disease.	*Ichthiophtherius multiphilis*	Parasite visible as white grit like spot on skin, fins and gills.Excessive mucus secretion. Erratic swimming movements. Skin detachments	Skin, fins, and gills. And entire body surface of the fish	Treatment with 1.5 mg/L^{-1} nitazoxanide. (NTZ) (Sutili, F. J., *et. al.*, 2013). Formalin 167-250 ppm) for up to 1 hour (Singh, I.B. and Yadava, Y.S., 2005). 6mg/L bath treatment Potassium permanganate. (Francis-Floydand Reed, 1991).
Marine water White spot disease or Ich disease.	*Cryptocaryon irriatans*	Produce white spots on the skin. And produce slightly smaller nodules. Exophthalmic eyes.	skin, gills and eyes of fish	Copper sulfate bath treatment of (0.5 ppm) for 5-7 days with good aeration and daily replenishment of water. Long bath treatment with 25 ppm formalin, for 5-7 days with good aeration and replacement of treated water daily (Jithendran, K. P. *et, al.*, 2014).
Trichodiniosis	*Trichodina spp.*	It infects mainly gills, body surface and fins and causes excessive mucus production on gills and body surface	Gills and skin.	Prolonged immersion of Potassium permanganate 2mg/L and 3 treatments are given 2-3 days. (Lacierda and Erazo-Pagador, 2004). Dip treatment of 8.5 -10 ppm

		with frayed fins.		high concentrations of Chloramine-T for 1 hour daily for 5 days is recommended. - Dip treatments 5 - 6.5 ppm lower concentration of Chloramine-T is used for 3 hours daily Singh, I.B. and Yadava, Y.S., 2005). - Vinegar 4%, acetic acid 10 ml/l), formaldehyde (0.15 ml/l), and salt 20 g/l) (F. Balta *et. al.*, 2008).
Hole-In-Head Disease/ Hexamitiasis	*Hexamita salmonis. Hexamita intestinalis*	Anaemia, exophthalmia and Dark coloration of Fish. And Internal signs yellow mucus in their intestines, Necrosis of the kidney.	Live, kidney, gall bladder	- Oral treatment of metronidazole can be administrated at a dose of 50 mg/kg body weight (10 mg/gm food) for 5 days Magnesium sulfate 0.2-0.3% in feed for 3 days proven effective (Francis-Floyd & Reed, 1994). - Long-term bath of 6 mg/ L metronidazole and after 24 hours, with 0.2 ppm malachite green mixed with 0.15 ppm formalin**.** for 10 days after the fish completely recovered (Peyghan, R., *et. al.*, 2010).
Ichthyobodoosis (Costiasis)	*Ichthyobodo necator*	Spots appear on the body surface and the	skin and gills	- Formalin 17-25 ml/100 L for 30-60 minutes.

		gills are usually swollen. Increased mucus secretions and frayed or destroyed fins.		- Dip treatment of 8.5-10 ppm of Chloramine – T for 1 hour daily for 5 days (Singh, I.B. and Yadava, Y.S., 2005). - Lower concentration of 5-6.5 ppm of Chloramine-T is used for 3 hours daily.

Advantage of therapeutants in protozoan parasitic disease in fishes

Therapeutants, also known as therapeutic agents or pharmaceuticals, are extremely important in the treatment and management of protozoan parasite diseases in fish. These parasitic diseases, caused by parasites such as *Ichthyophthirius multifiliis (Ich)*, *Cryptocaryon irritans* (marine white spot disease), and *Trichodina spp.*, can be fatal to fish and result in large economic losses in aquaculture. The following are some of the benefits of therapeutants in the context of protozoan parasite diseases in fish.

Effective parasite control: Therapeutants designed particularly to target protozoan parasites can efficiently remove or inhibit the microorganisms that cause the disease. These treatments may stop the parasites' life cycle, directly kill the parasites, or prevent their development and reproduction.

Ease of administration: Therapeutants are available in a variety of forms, including liquids, powders, and medicated feeds, making them easy to administer to fish. They can be introduced to the water where the fish live or included into their food. This adaptability in administration methods enables successful treatment of individual fish as well as large populations in aquaculture settings.

Rapid action: Many therapeutants for protozoan parasite infections are fast-acting. They can immediately destroy or block parasites, providing immediate relief to afflicted fish. This is especially critical in cases when the disease progresses quickly, as prompt treatment can considerably boost the odds of a full recovery.

Broad-spectrum activity: Some therapeutants have broad-spectrum activity, which means they can target several protozoan parasites. This adaptability is useful when the parasite causing the disease is difficult to identify or when numerous parasite species are present at the same time. Broad-spectrum therapeutants offer a comprehensive treatment approach that ensures successful control of many parasites.

Compatibility with fish: Therapeutants are frequently designed to be safe for use in fish species that are prone to protozoan parasite diseases. They are intended to have minimal negative effects on the treated fish, resulting in a low danger of toxicity or injury.

Disadvantage of therapeutants in protozoan parasitic disease in fishes

Therapeutants, which are substances used for therapeutic purposes in the treatment of protozoan parasitic diseases in fishes, do have some disadvantages. Here are few notable ones.

Development of Drug Resistance: Protozoan parasites have the ability to build resistance to therapeutants over time. When fish are exposed to therapeutants, some parasites may survive due to natural variances in their genetic makeup. These resistant parasites can then grow and spread, rendering the therapeutants ineffective in the long run.

Environmental Impact: Many therapeutants used in fish farming might be harmful to the environment. When these compounds are used to treat protozoan parasites, they may end up in nearby water bodies via effluent or runoff. This can pollute the water and harm other aquatic organisms, upsetting the ecological balance.

Harm to Non-Target Organisms: Non-target creatures such as beneficial bacteria, algae, or invertebrates present in the aquatic environment may be harmed by therapeutants used to treat protozoan parasites in fish. These unforeseen consequences have the potential to disturb the natural ecosystem and have a domino effect on other species.

Residue Accumulation: Even after treatment, some therapeutants may leave residues in fish tissues that might remain and increase over time. This can endanger human health if the fish are consumed, especially if the withdrawal periods are not followed correctly. The presence of therapeutant residues in fish can also result in trade restrictions and a decrease in marketability.

Limited Treatment Options: There are only a few therapeutants available for the treatment of protozoan parasite diseases in fish. This can be difficult since some parasites might develop resistance to specific therapeutants, leaving fish producers with fewer treatment alternatives.

Conclusions and future directions:

The majority of fish health issues are caused by environmental factors such as poor water quality, overcrowding, food inadequacies, or "stress." The most effective treatment for any fish health issue is prevention. An efficient and long-lasting control of parasites in aquaculture settings is difficult due to parasites' remarkable capacity to adapt to environmental changes. It is recommended that aquaculture use a number of strategies in an integrated disease control plan.Using should be between several chemical and pharmacological treatments for parasite disease control.

References.

Cruz-Lacierda, E. R., & Erazo-Pagador, G. E. 2004. Parasitic diseases. In Diseases of cultured groupers (pp. 33-57). Aquaculture Department, Southeast Asian Fisheries Development Center.

Singh, I.B. and Yadava, Y.S., 2005. Aquaculture medicine and aquatic animal health management. Aquaculture Authority, Tamil Nadu, India.

Francis-Floyd, R. and Reed, P., 1991. *Ichthyophthiriusmultifiliis* (white spot) infections in fish. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Pathak, S. C., Ghosh, S. K., & Palanisamy, K., 2000. The use of chemicals in aquaculture in India. In Use of Chemicals in Aquaculture in Asia: Proceedings of the Meeting on the Use of Chemicals in Aquaculture in Asia 20-22 May 1996, Tigbauan, Iloilo, Philippines (pp. 87-112). Aquaculture Department, Southeast Asian Fisheries Development Center.

Woo, P. T. (Ed.). 2006. Fish diseases and disorders. Volume 1: Protozoan and metazoan infections. CABI.

Buchmann, K., 2015. Impact and control of protozoan parasites in maricultured fishes. Parasitology, 142(1), 168-177.

Barzegar, M., Raissy, M., & Shamsi, S., 2023. Protozoan Parasites of Iranian Freshwater Fishes: Review, Composition, Classification, and Modeling Distribution. Pathogens, 12(5), 651.

Klinger, R. E., & Floyd, R. F., 1998. Introduction to freshwater fish parasites. Gainesville: University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.

Peyghan, R., Boloki, A., & Ghorbanpour, M. (2010). Case report and treatment of hole in the head in oscar, Astronotus ocellatus.

Francis-Floyd, R., & Reed, P. (1994). Management of Hexamita in ornamental cichlids. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.

Sutili, F. J., Gressler, L. T., Vargas, A. C., Zeppenfeld, C. C., Baldisserotto, B., & Cunha, M. A. (2013). The use of nitazoxanide against the pathogens Ichthyophthirius multifiliis and Aeromonas hydrophila in silver catfish (Rhamdia quelen). Veterinary Parasitology, 197(3-4), 522-526.

Balta, F. İ. K. R. İ., Kayis, S., & Altinok, I. (2008). External protozoan parasites in three trout species in the Eastern Black Sea region of the Turkey: intensity, seasonality, and their treatments. Bulletin of the European Association of Fish Pathologists, 28(4), 157-162.

Jithendran, K. P., Praveena, P. E., Bhuvaneswari, T., Otta, S. K., Poornima, M., & Patil, P. K., (2014). Training manual on Health practices for finfish and shellfish of brakish water Environment (CIBA 2014, Special Publication No. 74).