

Novel ways in chemotherapy against fish parasitic Microsporidia, Ciliophora, and Monogenea: a review

Neue Entwicklungen in der Chemotherapie gegen fischparasitierende Microsporidien, Ciliophora und Monogenea: Eine Übersicht

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Summary: The growing of aquatic culture systems and public and private display aquaria lead to an increase of parasite-related fish diseases, which can reach epizootic dimensions. Among Protozoa, microsporidians are often the agents of serious systemic diseases (e.g. *Pleistophora hyphessobryconis*, the cause of the „neon disease“). Actually, an established chemotherapy against microsporidian infections does not exist. Among the Ciliophora, the skin parasite *Ichthyophthirius multifiliis* is most important due to its ability to infect a wide range of freshwater fish and its high pathogenicity. Conventional control on this parasite is done by bath treatments containing solutions of malachite green. Among the Metazoa, the ectoparasitic monogenetic trematodes cause the most pathogenic helminth-borne infestations. As examples for two dangerous species the skin parasite *Gyrodactylus salaris*, „The Norwegian salmon killer“, and the gill parasite *Pseudodactylogyrus bini* in the European eel (*Anguilla anguilla*) are mentioned. Furthermore, many monogenean species have become resistant against conventional treatment, or introduced new species are not susceptible to standard control methods. In laboratory trials it was demonstrated, that different benzimidazole derivatives when applied in immersion therapy, have most deleterious effects on the merogonic and the sporogonic stages of the microsporidian *Glugea anomala* (Albendazole, mebendazole, or fenbendazole; three times incubation with one of these substances at 2 mg/l water for 6 h, at 36 h intervals). The application of medicinal flakes containing quinine to fish infected with *Ichthyophthirius multifiliis* is a new way to control this parasitosis (5 g quinine in a non-water soluble formulation / kg food; two times daily ad libitum). Different monogenean species were extremely sensitive to immersion therapy using solutions of praziquantel (Short-term bath: 10 mg/l for 3 h, or 20 mg/l for 1.5 h. Long-term bath: 4 mg/l for 24 h). In line with the treatment regimens given below, the novel antiparasitic measurements reported in this contribution were well tolerated by the fish species used in the pilot tests (i.e. three-spined stickleback, *Gasterosteus aculeatus*, sword-tail, *Xiphophorus helleri*, black molly, *Poecilia sphenops*, black neon, *Hyphessobrycon herbertaxelrodi*, common carp, *Cyprinus carpio*).

Keywords: Fish parasites, benzimidazole derivatives, quinine, praziquantel

Zusammenfassung: Parallel zum Ausbau der Aquakultur und zur vermehrten Haltung von Fischen in privaten und öffentlichen Schauaquarien hat auch das Auftreten parasitenbedingter Erkrankungen in erheblichem Maß zugenommen. Unter den Protozoa stellt die Gruppe der Microsporidia, so z. B. der Erreger der Neonkrankheit, *Pleistophora hyphessobryconis*, eine erhebliche Gefahr für empfindliche Fischarten dar. Eine etablierte Therapie gegen diese Parasiten fehlt bisher. Ein Vertreter der Ciliophora, der Hautparasit *Ichthyophthirius multifiliis*, nimmt aufgrund seiner Wirtsspezifität und seiner hohen Pathogenität eine besondere Stel-

lung ein. Die übliche Therapie der Ichthyophthiriasis erfolgt mit malachitgrünhaltigen Medizinalbädern. Unter den Metazoa sind Vertreter der monogenen Trematoden, wie z. B. *Gyrodactylus salaris* auf der Haut des Atlantischen Lachses (*Salmo salar*) oder *Pseudodactylogyrus bini* auf den Kiemen des Europäischen Aals (*Anguilla anguilla*), Verursacher der weitaus gefährlichsten Wurmerkrankungen bei Fischen. Zudem sind zahlreiche Monogenea-Arten mittlerweile resistent gegen konventionelle Therapiemöglichkeiten, oder neue Arten erweisen sich a priori als unempfindlich gegen bestehende Kontrollmaßnahmen. In Laborversuchen wurde nachgewiesen, daß Medizinalbäder mit verschiedenen Benzimidazolderivaten die Entwicklungsstadien des Microsporids *Glugea anomala* hochgradig schädigen (Albendazol, Mebendazol, Fenbendazol: dreimalige Behandlung mit wahlweise einer dieser Substanzen zu 2 mg/l Wasser für 6 h, im Abstand von je 36 h). Als therapeutische Alternative gegen *Ichthyophthirius*-Befall erwies sich die Verabreichung von chininhaltigem Medizinalfutter an erkrankte Fische (5 g Chinin in wasserunlöslicher Formulierung/1 kg Futter; 2 x täglich ad libitum). Gegen alle bisher untersuchten Monogenea-Arten erwiesen sich Bäder mit Praziquantellösungen als hoch effektiv (Kurzzeitbad: 10 mg/l für 3 h, oder 20 mg/l für 1,5 h; Langzeitbad: 4 mg/l für 24 h). Bei den hier erprobten Dosierungen wurden diese neuen Therapiemöglichkeiten von den getesteten Fischarten gut toleriert (Dreistachliger Stichling, *Gasterosteus aculeatus*, Schwertträger, *Xiphophorus helleri*, Black mollies, *Poecilia sphenops*, Schwarzer Neon, *Hyphessobrycon herbertaxelrodi*, Karpfen, *Cyprinus carpio*).

Schlüsselwörter: Fischparasiten, Benzimidazolderivate, Chinin, Praziquantel

1. Introduction

The intensive production of fish in hatcheries and broad-scale culture combined with the introduction of new species has inevitably been paralleled by increases in viral, bacterial, fungal and parasitic diseases. Regarding the fact that inadequate understanding of biological, physiological and nutritional requirement of the newly domesticated fish species is without doubt a major cause to losses, the high stocking densities of intensive farming favours a concentration of hosts and disease factors. However, among the causative agents of fish disorders often the protozoan and/or metazoan parasites cause severe losses.

With the development of aquaculture in the last three decades and further with the increasing number of private and public display aquaria there is an increase in attempts to proper control against protozoan and metazoan fish parasites.

A wide spectrum of simple chemicals, such as sodium chloride, potassium per-

manganate, copper sulphate, formaldehyde, acetic acid and various staining dyes is still used in high dilutions as external treatment for control of ectoparasites. Some of these chemicals, especially the salts and the fixatives, not only affect the parasite, but are harmful to the host. The limitations of such more general methods led to trials with different chemotherapeutics against a wider range of fish parasites. Actually, chemotherapy is considered as the most effective and flexible weapon against parasitic infestations.

Major problems to the use of chemotherapeutics may arise from restrictions due to public health implications of residues, when fish are raised for human consumption.

Protozoans are responsible for a range of infections from topical, often opportunistic, to systemic. Actually, the range of available treatments is limited. Systemic infections, often associated with the strictly intracellular parasitizing Microsporidia, are responsible for some of the most serious losses in fish, are much more refrac-