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Chemotherapy of Fish Diseases: a Review

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Introduction

Fish suffer from environmental, nutritional, viral, bacterial, parasitic, and neoplastic diseases, many of which are similar to those of higher animals. The prevention and treatment of these diseases follow the same principles as diseases of other animals.

Fish culture is similar to poultry husbandry in that large numbers of animals are crowded into relatively small areas, feeding is free choice, and medication for systemic infections is usually oral. External treatment of fishes is more common than of poultry, due to a higher frequency of external diseases.

Many of the drugs and chemicals used in chemotherapy of fishes are the same as for higher animals. The following is a brief review of the more important drugs and their methods of administration.

External Treatments

External treatments usually are added to the water although direct application may be useful with aquarium or experimental fish.

The following types of baths, varying primarily in strength of therapeutic agent and time of exposure, are used for administering external treatments:

Dip — fish are dipped into a concentrated solution of chemical for up to 1 minute.

Short bath — water flow is shut off, and chemical is added to the chamber at high concentrations, relative to toxicity, and allowed to remain up to an hour. The flow is then turned on and the chemical flushed out.

Long bath — low concentrations of chemical are added to ponds or aquaria and allowed to dissipate naturally.

Flush — the entire dose is added at the flowing inlet and allowed to spread through and out of the container. Water flow is continuous, and dose rates are about the same as for short baths.

Constant flow — a metering device is used to introduce concentrated chemical into the water flow to give a constant, continuous dose.

Fin and tail rots of aquarium fishes and bait minnows are treated with antibiotics or sulfonamides dissolved in the water. Antibiotics appear to be more effective and are usually used at a rate of 50-250 mg/gal.

The agent(s) involved in these "rot" diseases vary, thus it is advisable to identify the bacteria and determine drug sensitivity in each case. If facilities are not available for this, a mixture of drugs may give best results.

External myxobacterial infections in the early stages usually respond to treatment with disinfectants such as quaternary ammonium compounds (Roccal, Hyamines)[7] or ethylmercuric phosphate.[8]

Formalin baths are effective against the common protozoans, *Ichthyophthirius, Costia, Chilodonella,* and *Trichodina.*[2] Malachite green (zinc free) is also effective, however, it is more toxic than formalin and cannot be used on the tetra group of aquarium fishes. Acriflavine (Trypaflavine) and methylene blue also are used to remove protozoa infesting aquarium fish and may be used on other fish species.

Monogenetic trematodes infesting the gills and skin of fish are removed with a short bath of formalin.[2] Acetic acid and potassium permanganate have been used, but formalin seems to be preferred.

DDT and benzene hexachloride (BHC) have been found effective for removing parasitic copepods but they are highly toxic, have adverse effects on zooplankton and bottom fauna, and are persistent. Dylox*, an organophosphate lacking many of the disadvantages of the chlorinated hydrocarbons, has been reported recently as effective. Four weekly pond applications control the parasite.[3]

*Dylox (0,0-Dimethyl, 1,2,2,2 trichloro-1-hydroxyethyl phosphonate) Chemagro Corp., Kansas City, Missouri.

TABLE 1. *Fish Therapeutics*

Chemical	Dose	Disease
Acriflavine	10 ppm bath, 3-20 days	external protozoans of aquarium fishes
	2-4 ppm 24-48 hours	of catfish *(Ictalurus)*
Chloramphenicol	2.5-3.5 gm/100 lb. fish/day in feed, 7-10 days	bacterial infections
	3 mg i.p. single injection	prevent *A. liquefaciens*
Dylox	0.25 ppm active in ponds 4 weekly applications	parasitic copepods
Enheptin	0.2% in feed 3-5 days	*Hexamita*
Erythromycin	10 gm/100 lb fish/day in feed, 21 days	*Corynebacterium*
Ethylmercuric phosphate (Timsan)	1-2 ppm bath for 1 hour	gill disease
Formalin	250 ppm bath for 1 hour; in ponds, 25 ppm indefinitely	external protozoans, monogenetic trematodes, fungus
Furazolidone	1.2 gm/100 lb fish/day in feed, 20 days	furunculosis
Malachite green	1 ppm bath ½-1 hour; in ponds, 0.1 ppm indefinitely	external protozoans, fungus
Methylene blue	2 ppm daily in aquaria	external protozoans
Oxytetracycline	2.5-3.5 gm/100 lb fish/day in feed, 10 days	bacterial infections
Quaternary ammonium compounds (Roccal, Hyamine)	2 ppm active, bath for 1 hour	gill disease
Sulfonamides	10 gm/100 lb fish/day in feed, 14 days	furunculosis systemic myxobacteria
Tin oxide di-n-butyl	Total of 11.5 gm/100 lb fish given over 3 days	intestinal helminths

Internal Treatment

Medicated feeds are used for treatment of systemic infections or intestinal parasites. Suitable chemicals can be incorporated into dry, pelleted feeds or coated on them with gelatin - water, methyl cellulose, or feeding oil. For wet diets, the drugs are mixed in the dry meal portion prior to the addition of meat. We have a unique situation with medicated fish feeds. Dose rates of systemic drugs are calculated per kilogram of total body weight without regard for individual size or temperature. On the other hand, the amount of food given fish, particularly salmonids, does vary with size and temperature.[1] Thus the concentration of a drug in feed varies with temperature and fish size. In addition, the size of pellets varies with the size of fish. These variations make it necessary to order medicated fish feed as custom mixes to meet the requirements of a particular situation.

Injection of drugs into fish can be done intraperitoneally or intramuscularly with ease, while some skill is required for intravenous injections. Parenteral treatment is limited by use to control of diseases caused by *Aeromonas* and *Pseudomonas*. It may be used also for treatment of valuable aquarium or experimental fishes.

Systemic myxobacterial infections *(e.g.* columnaris, cold-water disease) do not respond to external treatments. Oral administration of sulfamerazine, sulfamethazine, sulfisoxazole or oxytetracycline is necessary to control these diseases.[13] Systemic infections due to *Aeromonas, Pseudomonas,* and *Vibrio* usually can be controlled by feeding oxytetracycline or chloramphenicol. Various sulfonamide drugs may be effective but drug resistance is an important problem. Some of the nitrofurans have been found to be effective against systemic infections.[5,10] Drug resistance to nitrofurans seems to be rare. Furazolidone (NF-180) has been successfully used for treating furunculosis *(A. salmonicida)* on a hatchery scale.

Antibiotics injected intraperitoneally can be effective in the prevention of *A. liquefaciens* infections in warm - water fishes as the water warms in the spring. This method is used extensively in Europe to protect carp against bacterial hemorrhagic septicemia. Chloramphenicol is the drug of choice, but oxytetracycline, tetracycline, and streptomycin are also used.[9]

Ulcer disease *(Hemophilus piscium)* is relatively rare today. However, when it is encountered, oxytetracycline or chloramphenicol are drugs of choice. This disease does not respond to sulfonamide therapy.[11]

Kidney disease *(Corynebacterium)* usually is treated with one of the sulfonamide drugs mentioned above. Erythromycin is the most effective drug tested,[12] but it is too expensive for general use. The value of drug therapy of kidney disease is questionable except in acute cases.

Because some bacteria *(e.g. Streptococcus, Flavobacterium)* which are uncommon fish pathogens are isolated occasionally and because some common pathogenic bacteria, especially *A. salmonicida,* readily develop drug resistance, positive identification and drug sensitivity tests are essential to proper therapy.

Hexamita salmonis is an intestinal protozoan which can be detrimental under certain circumstances. For *Hexamita* treatment, Enheptin** has been suggested as a replacement therapeutic agent for carbarsone and calomel, which are highly toxic.[6]

Helminths, both cestodes and nematodes, are the intestinal parasites of prime importance of hatchery fishes. Many of these can be removed by feeding di-n-butyl tin oxide.[1]

The drug uses mentioned above and the dose rates listed in Table 1 have been reported in the literature. It should be noted, however, that only sulfamerazine currently has the approval of the

**2 - amino - 5 - nitrothiazole (American Cyanamid).

Federal Food and Drug Administration (F.D.A.) for use in food fishes and only under the following conditions:

Sulfamerazine: Control furunculosis in rainbow, brook and brown trout; 10 gm/100 lb/day for up to 14 days; withdraw 21 days prior to stocking or marketing; a zero tolerance (no detectable residues at time of marketing) is established for the muscle.

Oxytetracycline is now being processed by F.D.A. for clearance.

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