ANTIMYCIN (FINTROL) AS A FISH TOXICANT

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Among the objectives of the Fish Control Laboratories at La Crosse, Wisconsin and Warm Springs, Georgia is the investigation and development of fish toxicants which can be used effectively and safely in the management of fish populations. We have concentrated efforts in the past two years on an antibiotic named antimycin. Intensive trials in the laboratory and field have provided evidence that the chemical possesses qualities which distinguish it from other fish toxicants. Its principal advantages are: it is lethal in p.p.b. to certain target species of freshwater fish, including carp; its effect on most species is irreversible; it does not repel fish; it works well in cool and warm waters and in the presence of aquatic plants; it degrades rapidly; it has low mammalian toxicity; and it has little effect on phytoplankton, zooplankton, aquatic insects and amphibians.

Antimycin was isolated from the fungus-like bacteria *Streptomyces* and identified by Dunshee, Leben, Keitt and Strong (1949) at the University of Wisconsin. Derse and Strong (1963) related that it is extremely toxic to goldfish but not to mammals at 1 p.p.b. This and its rapid degradation suggested a use in fish management. Its mode of action is highly selective inhibition of the electron transport in the oxidation-phosphorylation system (Strong 1956). Thus, it retards the respiration of cells. It is assumed that the toxicant is absorbed into the gills of fish.

Antimycin has been tested in the laboratory against 31 species of fish. The more susceptible species succumbing to 1 p.p.b. were: gizzard shad; rainbow, brook, brown and lake trouts; white sucker; Iowa darter; yellow perch; walleye; northern pike; stoneroller; goldfish; carp; golden shiner; fathead minnow; bigmouth buffalo; brook stickleback; green sunfish; pumpkinseed; bluegill; longear sunfish; largemouth bass; smallmouth bass; white crappie and freshwater drum. Less sensitive species requiring up to 20 p.p.b. were shortnose gar, bowfin, and channel catfish. Black and yellow bullheads displayed the greatest resistance, requiring up to 120 p.p.b. Various sizes and life stages of fishes were included in the tests (Walker, Lennon, and Berger, 1964).

It was of particular interest to find that carp are vulnerable to low concentrations of antimycin. Since carp are considered to be one of the most undesirable fishes in freshwaters, and in view of their demonstrated ability to survive other types of control measures, the effectiveness of antimycin against this particular fish was a welcome discovery.

Antimycin is also toxic to fish eggs. Fertilized eggs of rainbow trout, northern pike and white sucker were killed by 10 p.p.b. at 54° F. after two-hour exposures. Goldfish eggs were killed by 7.5 p.p.b. at 63° F., and carp by 5.0 p.p.b. in the same exposure period and at the same temperature.

Factors which affect the performance of antimycin are: concentration of the toxicant in the water, duration of exposure, pH, alkalinity, water hardness and water temperature. At pH values above 8.5 there is a rapid breakdown of the chemical. The toxicant is slightly more effective in soft waters, and as temperatures increase so does the susceptibility of all species.

Daphnia, damsel flys, tadpoles, and salamanders were exposed to antimycin. Daphnia were killed at a concentration of 10 p.p.b. in 24 hours at 54° E. while damsel fly larvae died at 100 p.p.b. in 48 hours at the same temperature. Bullfrog tadpoles were killed by 40 p.p.b. in 24 hours at 54° F., tiger salamanders required 600 p.p.b. over a 24-hour exposure period at 54° F. to succumb.

Antimycin in acetone formulation at 10 p.p.b. killed 16 species

including carp and goldfish in medium hard water at Delafield, Wisconsin. Longnose gar, bowfin and bullheads were not greatly affected. A similar formulation at 1.2 p.p.b. killed 12 species in a small soft water pond in Georgia. These promising results led to the formulation of antimycin on sand to facilitate application in the field.

The sand formulation at 1.2 p.p.b. killed 17 species in a very soft, cool water pond in New Hampshire, and only black bullheads escaped. The same formulation at 10 p.p.b. was very effective on two trouts, six cyprinids, six sunfishes and freshwater drum in medium hard water ponds in northern New York. Bowfin and brown bullheads were not affected.

Additional trials were conducted in one-half acre ponds at Stuttgart, Arkansas. The toxicant at 7.5 and 10 p.p.b. produced 100-percent mortality in rainbow trout, goldfish, Israeli carp, golden shiner, smallmouth and bigmouth buffalo, warmouth, orange-spotted sunfish, green sunfish, bluegill, largemouth bass and white crappies. Only catfish survived.

Last spring, the sand formulation was tested in two ponds at Valentine, Nebraska. Ten p.p.b. eliminated very large populations of carp, fathead minnow and green sunfish. Only a few adult northern pike, largemouth bass, black crappie and all bullheads survived in one pond. There was question at the time whether all the toxicant entered the water because of high winds. There was no survival of fish in the second pond.

The field trials in 17 ponds located in six states included waters from 10 to 220 p.p.b. total hardness, temperatures from 50 to 90° F., pH 6.8 to 8.9, clear to moderate in turbidity, and light to moderately infested with aquatic weeds. Complete degradation occurred in moderately hard waters between two to seven days, whereas cool, soft waters required up to two weeks.

Recent tests show that antimycin is readily detoxified by potassium permanganate. For example, 10 p.p.b. of toxicant were deactivated by 1.0 p.p.m. of $KMnO_4$.

The studies on antimycin in the laboratory and field demonstrate that the chemical has fine potential as a fishery tool. Ayerst Laboratories, New York, has filed application with USDA for registration of the compound as a fish toxicant. The product is to be known as Fintrol.

In summary, 5 to 10 p.p.b. of antimycin are likely to be effective against target fishes, including carp, in most field situations. The formulation on sand looks good in regard to logistics and in treating temperature-stratified, and/or weed-infested waters.

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