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Short Communication

ERADICATION OF FISHES BY APPLICATION OF AMMONIA*

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ABSTRACT

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A simple method is described for the eradication of undesirable fishes from fish culture ponds by application of ammonia. Modifying an earlier technique of direct injection of anhydrous ammonia, a trial was carried out in which ammonia was released by the application of solutions of calcium hydroxide and ammonium sulphate in a ratio of 1:1.8. Ammonia at a concentration of 15 ppm (12.4 ppm N) killed plankton, minnows and predatory fishes including the air breathing species. The advantages of the method are discussed.

INTRODUCTION

In scientific fish culture, it is important to eradicate naturally occurring unwanted fishes, as they not only compete with the candidate species for food and space but some also directly prey on them. Various methods have been adopted in India for the eradication of undesired fishes from culture ponds. Mechanical removal by net may not be thorough, as some of the bottom dwellers like catfishes and murrels have the habit of burying themselves in mud during seining. Many fish poisons, both chemical and of plant origin, have been reported to be effective in the control of undesired fishes. Organophosphorous chemicals such as phosphamidon and dichlorvos (DDVP) were found to be lethal to fishes (Srivastava, 1966; Konar, 1969). Chlorinated hydrocarbons were tested for the eradication of aquatic organisms (Chaudhuri, 1960), but these chemicals are extremely harmful to man and livestock. They will also accumulate in fish flesh and therefore their use should be discouraged. Bhatia (1970) reported that the oil cake of 'Mahua' (*Bassia latifolia* Roxb.) could be used as an effective fish poison. Mahua is widely used in India at present, but large quantities of it are required for an effective treatment. Das (1969) described the use of the plant *Derris trifoliata* Lour as a powerful toxicant. Rotenone, a product of the derris plant, is the most

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common piscicide used in many parts of the world. However, the above-mentioned poisons of plant origin suffer from the limitations of short supply and non-availability.

Ramachandran (1963) injected anhydrous ammonia, using an applicator, directly into weed-choked water for the control of submerged weeds and this was also effective in killing fish at the concentration of 12 ppm N. In the present study, this method was simplified to avoid the difficulties in handling the gas and the special applicator. Ammonia was released by mixing solutions of ammonium sulphate and slaked lime.

MATERIALS AND METHODS

The modified technique was tested in a pond of 0.05 ha, situated in the Krishnapuram Palace, Kerala, India. It was difficult to empty the pond completely and hence the water depth was reduced to 1 meter by pumping. Separate solutions were prepared by dissolving 30.5 kg ammonium sulphate $[(NH_4)_2SO_4]$ in 60 l water and 30 kg slaked lime $[Ca(OH)_2]$ in 60 l. Small quantities of both the solutions were mixed in equal proportions and immediately splash distributed in the entire pond for rapid dilution and to prevent any escape of ammonia. For uniform mixing, water was disturbed mechanically.

Struggling fishes were collected by hand net and inactive ones removed 6 h after treatment by hand picking and drag netting.

Water was analysed for pH and plankton content 12 h, 10 days and 20 days after treatment. Alkalinity was estimated 12 h after treatment only.

RESULTS

Within 12 h of treatment there was complete destruction of all fishes; the species killed included *Chela* spp., *Esomus* sp., *Rasbora* sp. and other minnows, *Etroplus suratensis* (pearl spot), carnivores such as *Wallago attu* (river catfish) and *Channa striatus* (striped murrel) and omnivores such as *Clarias batrachus* and *Heteropneustes* sp.

Minnows were the first to be killed, while air-breathing fishes were distressed for some time before dying. Plankton was totally destroyed.

The initial pH of 6.3 increased to 10.3 after the treatment. It decreased to 9.0 after 10 days and stabilized at 7.6 after 20 days. Carbonate and bicarbonate concentrations in the water were 10 and 38 ppm, respectively, as a result of ammonia application. Plankton was found to reestablish after 20 days (2 ml/45 l).

DISCUSSION

Ramachandran (1963) attributed the toxicity of ammonia to the unionized molecular state under conditions of high pH and low CO_2 concentra-

tion. A pH of 10.3 and low free CO_2 concentration, indicated by the combined carbonate and bicarbonate alkalinity, were attained in the present study and led to the satisfactory results.

Ramachandran (1963) also reported that ammonia applied at 12 ppm N was effective in killing fish. A concentration of 12.4 ppm N was attained by adding 30.5 kg ammonium sulphate/500 m^3.

Although one part of calcium hydroxide was sufficient to fully liberate the ammonia contained in 1.8 parts of ammonium sulphate (ratio based on molecular weight), a higher dosage of slaked lime (almost equal in weight to ammonium sulphate) was used because it was of commercial grade.

Ammonia has all the desirable qualities of an ideal fish toxicant as detailed by Jhingran (1975). Fishes killed by ammonia are suitable for human consumption and do not produce any undesirable side effects. Ammonia, unlike the chlorinated hydrocarbons, is not fixed metabolically but, on the contrary, some part of it may enter the productive cycle of water (as indicated by the increased rate of plankton production in the treated pond) and this, incidentally, is advantageous in reducing the initial dose of nitrogen fertilizer to the pond.

The usefulness of this method is limited to unbuffered, soft-water environments, where ammonia will raise the pH and remain in un-ionised and toxic form to kill the fish.

The method is simple, safe and easy to adopt. It does not require any special type of applicator. The chemicals employed are easily available and economical. This simple technique is ideally suited for ponds which are difficult to drain and water bodies smaller than 0.1 ha, where use of anhydrous ammonia is not economical.

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