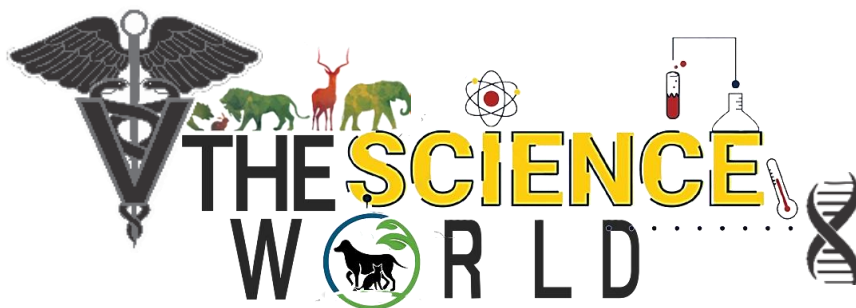




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Plant-Based Poisons as a Traditional Method for Fish Removal from Aquaculture Ponds

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Introduction

Aquaculture ponds are often invaded by unwanted, weed and predatory fish. Plant-based poisons used to control unwanted fish in aquaculture are commonly known as botanical piscicides or herbal piscicides. They are derived from different parts of plants such as seeds, roots, leaves, fruits, bark and oil cakes. Small, seasonal ponds are generally more suitable for fish farming because they are easier to manage and can be completely drained to remove unwanted and harmful fish. Whereas, large and deep ponds are more difficult as well as expensive to drain. So, alternate methods are required to control unwanted and predatory fish. These unwanted fish may enter ponds naturally or accidentally along with fish larvae and can adversely affect the fish survival and growth. Therefore, their effective control is essential for achieving better results in carp farming (Das et al., 2017). Since ancient times, people around the world have used plants with piscicidal properties to stun or capture fish. In recent years, researchers have identified many of the plant species which possess natural toxic compounds of killing or controlling. (Cannon et al., 2004).

Plant-based poisons are mainly used during pre-stocking pond preparation to eliminate Predatory fishes, weed fishes, unwanted fishes accidentally introduced with seed and some aquatic insects and other undesirable organisms. Unwanted fish compete with cultured fish for food, dissolved oxygen, space and other resources, and predatory fish may directly consume stocked fry and fingerlings. Therefore, their removal is an important part of pond preparation. Many plant based piscicides are used for the removing the predatory and weed fish with



appropriate concentrations. Among the various plant-based piscicides reported in the literature, five commonly used plant sources are discussed below for their potential application in aquaculture ponds.

1) Mahua oil cake

Mahua Oil Cake (MOC) is very common in Indian aquaculture, especially for pond preparation. It serves a dual purpose as piscicide and an organic manure. Mahua oil cake, a derivative from the plant *Madhuca longifolia*, is extensively used in aquaculture practices in India as a fish toxicant and an organic manure in fish ponds after its toxic effects are completely reduced.

In mahua oil cake, the triterpenoid saponins is the active compound responsible for the toxic effect of mahua oil cake. Saponin can destroy the red blood cells, reduce oxygen uptake, alter haemoglobin concentrations and may also damage the gills of aquatic animal. It is relatively easy to apply in pond water, it is commonly soaked in water for 12-24 hours to prepare slurry, which is then distributed evenly over the pond surface. The water may be stirred to simplify uniform dispersion and contact with unwanted fish. Fish exposed to the active compounds may become inactive and eventually die. The reported application dose for mahua oil cake is 250 mg/L (250 ppm). The time required to achieve complete mortality varies depending on fish species, environmental conditions and other factors; under some reported conditions, approximately 9-10 hours may be required for complete mortality (Ayoola, 2011). The persistence of mahua oil cake toxicity in pond water depends mainly on the dose and environmental conditions. The toxic effect may persist for several days, while complete detoxification may require a longer period. CIFRI (1968) reported a detoxification period of approximately 13–20 days and according to Nath (1983), the toxic period could be reduced from approximately 20–25 days to 7–11 days through the use of mechanical aeration.

2) Derris root powder (Rotenone)

Derris root powder is the common insecticide and weedicide used in aquaculture pond management. Because it has naturally plant-based poison, active compound is rotenone. Generally, rotenone is obtained from the root of *Derris species*, which have been traditionally used for pest and fish control. Studies conducted in the Mekong Delta of Vietnam have reported rotenone-containing *Derris* root products, with rotenone concentrations varying from approximately 1.5 to 5%. It acts as a selective, non-specific botanical insecticide and piscicide in aquaculture pond. It primarily affects cellular respiration by interfering with the utilisation of oxygen at the cellular level. In fish, rotenone can harm respiratory function and ultimately lead to oxygen deprivation and mortality.



Derris root powder is relatively easy to apply, prepare the powder from the roots and soaked in water overnight to prepare an aqueous suspension. On the next day, a milky solution distributed over the pond surface to facilitate contact with unwanted fish. The toxic effect develops over several hours, and mortality may occur within approximately 6-12 hours under suitable conditions. However, 2-5 weeks required for the pond to become completely free of rotenone toxicity can vary considerably depending on the application rate, water temperature, sunlight, organic matter and other environmental conditions. Therefore, the pond should not be restocked until adequate detoxification has been confirmed.

3) Tea seed cake/ tea seed powder

Tea seed cake is the residue left after oil is extracted from tea seeds. Tea seed cake as a piscicide to kill unwanted, predatory and weed fishes before stocking cultured fish seeds. The piscicidal activity of tea seed cake is mainly linked to saponins, which act as haemolytic agents. Saponins can damage the cell membranes of red blood cells, leading to haemolysis and reduced oxygen transport. As a result, fish may become stressed and eventually die. The toxicity of saponins generally decreases relatively quickly after application. Under suitable conditions, the piscicidal effect may last for approximately two days. However, fish mortality may continue after this period due to reduced dissolved oxygen or the release of carbon dioxide during the decomposition of the organic matter present in the cake. Most plant-derived piscicidal compounds degrade naturally over time, and the remaining organic matter can eventually contribute nutrients to the pond. The reported period for degradation and detoxification may range from approximately 7–12 days, depending on environmental conditions (Das et al., 2017).

4) Tobacco waste

Tobacco waste is derived from the tobacco plant, *Nicotiana tabacum*. The major active compound present in tobacco is nicotine. Review literature has reported nicotine as an important pesicidal component of tobacco leaves. Nicotine can act on the nervous system of aquatic organisms and may cause toxicity by interfering with normal nerve function. In addition, the decomposition of tobacco derived organic matter can contribute to oxygen depletion in pond water, which may further increase stress on unwanted fish and other aquatic organisms.

Historically, tobacco waste has been used in pond management, particularly for controlling aquatic insects and other unwanted organisms. However, because nicotine is a biologically active and toxic compound, the use of tobacco waste in aquaculture requires



considerable caution, particularly because of its potential effects on non-target organisms and the aquatic environment.

5) Croton seed powder

Croton seed is the toxicant commonly used for the eradication of unwanted aquatic organisms, pests, and predatory fish in fish farms. The toxicity of croton seed varies among fish species, with reported lethal concentrations ranging from 0.4 to 2.2 ppm. The study found that different fish species need a different doses of croton seed powder for the eradication. Its residual toxicity may persist for approximately 5-8 days in stagnant ponds and 1-3 days in tidal ponds, making it particularly useful during initial pond preparation before fish stocking (Divakaran, & Balakrishnan Nair, 1983).

Why are plant-based piscicides widely used in aquaculture?

Plant-based piscicides are widely used in aquaculture, particularly during pond preparation, because of their availability, relatively low cost and potential biodegradability. The major advantages include:

- Locally available – Many plant-based piscicides are readily available locally and may be obtained from agricultural or plant-processing by-products.
- Relatively low cost- They are generally inexpensive compared with some synthetic chemical toxicants.
- Biodegradable – Many botanical compounds are biodegradable and may break down relatively quickly under suitable environmental conditions.
- Useful during pond preparation- They can be effectively used during pond preparation to eliminate unwanted, weed and predatory fish before stocking the cultured species.
- Additional nutrient contribution - Some materials, particularly oil cakes, can subsequently contribute organic matter and nutrients to the pond after their toxic effects have declined.
- Useful where complete drainage is difficult - Plant-based piscicides can be particularly useful in ponds where complete drainage is difficult.

Conclusion

Plant-based piscicides have been traditionally used in aquaculture ponds to eradicate unwanted, predatory, and competing fish before stocking cultured species. Different plants have demonstrated piscicidal properties and may be effective in pond preparation when properly evaluated. Their use may offer a plant-derived alternative to synthetic fish toxicants, but their effectiveness depends on the plant species, dose, water quality conditions, and target fish species. However, because some plant-based toxicants can also affect non-target aquatic



organisms and may pose environmental and human-health risks, their application should be carefully controlled. Therefore, further research on safe dosage, residue degradation, environmental impact, and regulatory approval is important before their wider adoption in modern aquaculture.

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