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Tobacco dust: natural molluscicide for aquaculture applications

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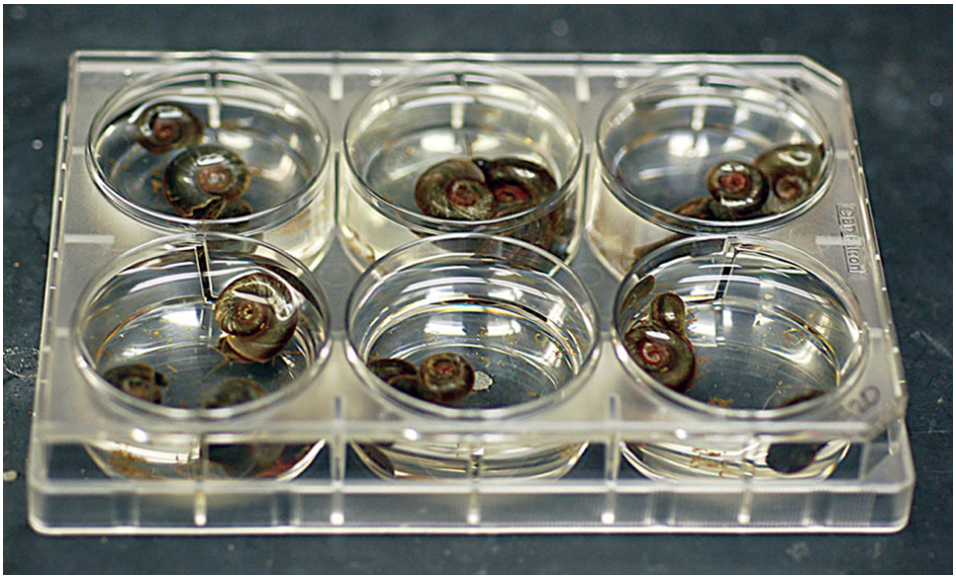
By David D. Kuhn, Ph.D. , Dan P. Taylor , Mary E. Mainous and Stephen A. Smith

Various concentrations effective against predatory snails



Ramshorn snails, a common species found in freshwater aquaculture ponds, were exposed to various concentrations of tobacco dust.

The freshwater snails commonly found in aquaculture ponds are problematic because they serve as an intermediate host for a number of trematode parasites. Trematodes, parasitic flatworms such as Bolbophorus species, can infect fish. Infected fish can develop encysted parasites in muscles, have impaired growth and become susceptible to other diseases that weaken and kill the fish.

The final hosts for these parasites are birds, and trematode eggs are spread to fish ponds when birds defecate. The eggs then hatch and the ciliated larval stage infests snails. The snails, in turn, release free-swimming larvae that infest fish, and the life cycle is completed when a bird eats the second intermediate host fish. To control these parasitic worms, the life cycle can be broken by controlling the snail population.

Snail control

Currently, the common method for controlling snail populations is the application of chemicals such as copper sulfate, often in conjunction with hydrated lime. Chemical applications can have drawbacks that include persistence in the environment and toxic effects to fish and non-target organisms. Alternative control methods that have been suggested include increasing the salinity of ponds using salts or using fish species that consume snails, such as black carp.

Natural pesticides may have an advantage over chemical pesticides because they tend to have shorter lives and are less likely to accumulate in the environment. Tobacco dust, a natural waste product of the tobacco industry, is an example of a natural pesticide that could be used as a molluscicide.

Research supported by Altria Client Services Inc. evaluated the effects of tobacco dust on snails and examined the related impacts on the survival of cultured fish.

Ramshorn snail study

Ramshorn snails (Planorbella trivolvis) are a common snail found in freshwater aquaculture ponds. In a study, the snails were exposed to various concentrations of tobacco dust with 7,200 µg/g nicotine over a three-day period. Test concentrations included a control with no nicotine and concentrations of 0.05, 0.25, 0.50, 1.00 and 2.50 g tobacco/L. One hundred eight snails were divided among 36 wells, and each tobacco concentration had six replicates.

The trial was repeated a second time to confirm initial results. The survival rates of snails were used to determine the toxic effects of the tobacco dust.

Tobacco dust was effective in killing snails within three days (Fig. 1). As expected, an increase in concentration resulted in higher mortality rates. Concentrations of tobacco dust of 0.5 g/L and higher significantly impacted snail populations. The 72-hour lethal concentration to kill 50 percent of the snails was estimated as 1.7 mg/L nicotine. The estimated concentration to kill 99 percent of the snails in 72 hours was 5.4 mg/L nicotine.

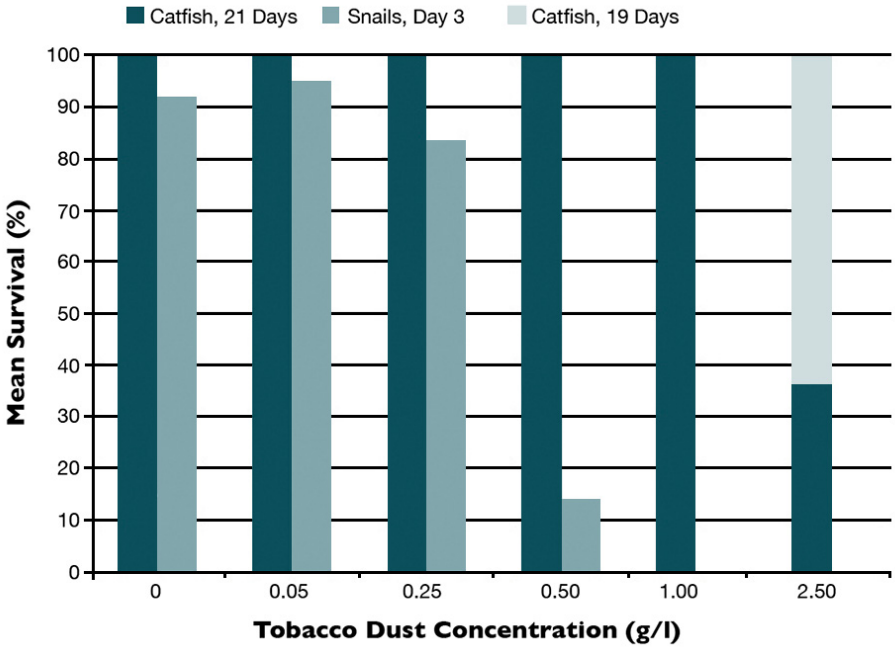


Fig. 1: Survival of snails and catfish exposed to various concentrations of tabacco dust. The toxicity of tabacco dust declined rapidly.

Channel catfish study

In a related study, channel catfish (*Ictalurus punctatus*) were exposed to various concentrations of tobacco dust with 8,200 µg/g nicotine over a 21-day period. For the common foodfish species raised by aquaculturists in North America, test concentrations included a control without nicotine and the same tobacco dust concentrations used in the snail study. Eighteen 75-L aquaculture systems were stocked with 10 fish each, and each tobacco concentration had three replicates.

This trial was repeated a second time. As in the snail study, survival rates were used to determine toxic effects of tobacco dust concentrations.

Tobacco dust did not negatively impact catfish survival rates at tobacco concentrations of 1.0 g/L nicotine or lower (Figure 1). At 2.5 g/L tobacco dust – five times the lethal concentration for the snails – catfish survival was 37 percent. Interestingly, all catfish mortalities occurred within the first day.

Catfish were restocked into the same systems the next day, and no additional catfish died. This indicated the tobacco dust was significantly less toxic within a few days of application.

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Authors

DAVID D. KUHN, PH.D.

Department of Food Science & Technology
Virginia Polytech Institute and State University
FST Building (0418)
Blacksburg, Virginia 24061 USA

davekuhn@vt.edu (mailto:davekuhn@vt.edu)

DAN P. TAYLOR

Department of Food Science & Technology
Virginia Tech
Blacksburg, Virginia, USA

MARY E. MAINOUS

Department of Food Science & Technology
Virginia Tech
Blacksburg, Virginia, USA

STEPHEN A. SMITH

Department of Biomedical Sciences & Pathology
Virginia-Maryland Regional College of Veterinary Medicine
Virginia Tech
Blacksburg, Virginia, USA