



ARTIFICIAL INSEMINATION OF THE LYRETAIL



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Introduction

Over the past eight years, the University of Hawai'i Sea Grant College Program has been working collaboratively to support the development of a freshwater tropical ornamental fish industry in Hawai'i. This effort with the United States Department of Agriculture Center for Tropical and Subtropical Aquaculture, the Hawai'i State Department of Agriculture Aquaculture Development Program and Windward Community College will expand Hawai'i's aquaculture production and diversify the state's economy.

Through these partnerships, the Windward Community College (WCC) Aquaculture Complex was established to host a variety of research and extension activities.

Currently, the WCC Aquaculture Complex is hosting research to develop methodology that will increase the production of the lyretail swordtail, a fancy livebearer valued at 2-3 times that of the common swordtail.

The lyretail characteristic causes elongation of all fin rays. However, due to the overdevelopment of the gonopodium, lyretail swordtail males cannot physically mate naturally with lyretail females.

It has been hypothesized that the lyretail trait is a dominant genetic characteristic. Currently, lyretail swordtails are produced by mating a common male with a lyretail female, resulting in a maximum of 50 percent lyretail offspring.

In addition, all lyretails are genotypically heterozygous for the lyretail trait. Production of individuals that are homozygous for the lyretail trait would be extremely valuable, as 100 percent of their offspring would be lyretail.

As a result, development of the methodology to produce homozygous lyretail individuals would greatly enhance the economic output of a swordtail aquaculture enterprise.

1999-2003 Sea Grant Funding

Matching funds: \$245,000

Activities

Artificial insemination of the Lyretail swordtail includes the following objectives:

- Validate that mating a common male with a lyretail female produces 50 percent lyretail offspring
- Adapt the hobbyist's artificial insemination techniques on livebearers to successfully cross a lyretail female with a lyretail male
- Demonstrate that the lyretail trait is a dominant characteristic inherited in Mendelian fashion by the production of a homozygous individual
- Validate the existence/production of homozygous lyretail individuals through artificial insemination and by progeny testing
- Update and improve the WCC Aquaculture Complex for continued use as a research platform and for general public use



Artificial insemination of the lyretail swordtail.

Results and Impacts

By using the artificial insemination techniques at the WCC Aquaculture Complex, a lyretail male has been successfully crossed with a lyretail female. In addition, it was validated that the lyretail trait is a dominant genetic characteristic and is being inherited following the Principle of Mendelian Segregation.

The existence of a homozygous lyretail individual was confirmed through progeny testing and, as a result, it was demonstrated that quality lyretail production could be obtained from homozygous lyretail females.

LYRETAIL TO COMMON CROSS



TOTAL OFFSPRING: N=286
OBSERVED: 145 LYRETAIL : 141 COMMON
EXPECTED: 143 LYRETAIL : 143 COMMON
Chi Square = 0.06, P>0.05

EXPECTED OUTCOME OF PROGENY TESTING TO IDENTIFY A HOMOZYGOUS INDIVIDUAL

Punnet Square

Genotype	L	L
l	Ll	Ll
l	Ll	Ll

Phenotype = 4 lyretail : 0 Common

In addition, UH Sea Grant Extension has:

- Conducted three workshops to provide hands-on training in artificial insemination techniques
- Conducted on-farm testing
- Produced a manual that provides step-by-step instruction in techniques of artificial insemination for swordtails

Education

The WCC Aquaculture Complex and UH Sea Grant Extension personnel provide an educational field trip destination, and work closely with intermediate school students of the Hakipu'u Learning Center, the Kamalama Project of the Pacific American Foundation, as well as University of Hawai'i students.

These students become familiar with collaborative aquaculture projects and the demonstration of simple water bio-filtration and aquaponics systems.

Publications/Presentations

McGovern-Hopkins, K., G. Takeshita and C.S. Tamaru. 2003. Creating the homozygous genotype for the lyretail trait in swordtails. *Aquatips, Regional Notes, Center for Tropical and Subtropical Aquaculture*. Vol. 14, No. 4, December 2003.

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lyretail swordtail, *Xiphophorus helleri*. Center for Tropical and Subtropical Aquaculture, Publication No. 149, 16 pp.

McGovern-Hopkins, K., C.S. Tamaru, G. Takeshita and M. Yamamoto. 2003. Production of the homozygous genotype for the lyretail trait in swordtails (*Xiphophorus helleri*) using artificial insemination. *World Aquaculture 2003, Salvador, Brazil, May 19-23, 2003. Book of Abstracts*, 477.

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McGovern-Hopkins, K., C.S. Tamaru, G. Takeshita and M. Yamamoto. 2003. On the use of artificial insemination for the commercial production of lyretail swordtails. *Aquatips, Regional Notes, Center for Tropical and Subtropical Aquaculture*. Vol. 13, No. 2, June 2002.

Partners

- USDA Center for Tropical and Subtropical Aquaculture
- Honolulu Aquarium Society
- Hawai'i Department of Agriculture Aquaculture Development Program
- Windward Community College



University of Hawai'i Sea Grant Aquaculture Extension Agent Kathleen McGovern-Hopkins works with the freshwater ornamental fish project at Windward Community College to provide Hawai'i farmers and students with aquaculture expertise.

McGovern-Hopkins comes from a distinguished aquaculture career with several aquaculture enterprises in Hawai'i, as well as the Waddell Mariculture Center in South Carolina.

McGovern-Hopkins has considerable experience in phytoplankton culture and hatchery technologies in shrimp culture, along with a variety of finfish and ornamental fish expertise.

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Overall Results



Batch #1: Total of 13 Females
Observed: 3F 100% lyretail: 10F lyre/Common
Expected: 3F 100% lyretail: 10F lyre/Common

