

DEVELOPMENTAL HISTOLOGY OF GONADAL SEX DIFFERENTIATION

IN FATHEAD MINNOW

(Pimephales promelas)

Cevdet Uğuz

Texas Tech University, Dept. Range, Wildlife and Fisheries Management
Lubbock, TX 79409-2125
806-742-0841; email: c7uca@ttacs.ttu.edu

Reynaldo Patiño

Texas Cooperative Fish & Wildlife Research Unit, Texas Tech University
Lubbock, TX 79409-2120

Introduction

Fathead minnows are commonly used as research models for toxicological studies. Although exogenous steroid-induced and temperature-dependent sex differentiation have been studied in many fishes, the effects of environmental endocrine disruptors on sex determination and differentiation in fathead minnow as well as in other fishes have yet to be examined. In fathead minnows, the developmental histology of gonadal sex differentiation has also not been studied. Our interest is to establish the fathead minnow as a laboratory model for studies of the effects of environmental endocrine disruptors on sex differentiation and early reproductive development. As the first step towards this goal we are conducting studies to examine the histological pattern and timing of gonadal sex differentiation and the effects of exogenous estradiol-17 β on sex determination. Here we report our initial findings on the developmental histology of the gonads.

Results and Discussion

Fish samples were taken from Day 3 post spawning through Day 150 post spawning. Gonadal tissues were sectioned in paraffin (5 μ m), stained with H-E and examined under the microscope. Histological analysis of gonadal sex differentiation in fish from Day 13 to Day 60 have been completed. Fish from Day 13 (fork length, 7-9 mm) appeared to show differences in gonad size. Two individuals in this group had relatively large gonads (39-63 and 40-50 μ m in diameter), whereas five individuals showed smaller gonads (15-33, 25-39, 23-41, 20-34, and 20-30 μ m in diameter). The germ cells did not show significant size differences among in these fish. The larger gonads in fish from Day 16 (fork length, 10-11mm) showed germ cells in the "bouquet" stage of meiosis, which is typical of oocytes. Fish from Day 22 (13-17 mm) had well-developed ovaries containing perinucleolar oocytes and an ovocoel. However, there was no clear testicular differentiation until Day 60 post spawn in presumptive males. Lobules and seminiferous duct formation were evident in these fish. These results suggested that sex differentiation in the fathead minnow occurs around Day 13 post spawning in the fathead minnow. This result will be used to design experiments to determine the effects of chemical and thermal pollution on sex differentiation.

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