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**EFFECTS OF RADIO-FREQUENCY ELECTRICAL FIELDS
ON THE BEHAVIOR OF
THE YELLOW PERIWINKLE, *STREPTA HILARIS* (L.)**

by

ANDREW MICHAEL A. A. LADSON

A Thesis

**Presented to the Faculty of
the Graduate College in the University of Nebraska
in Partial Fulfillment of Requirements
for the Degree of Doctor of Philosophy
Department of Entomology**

Under the Supervision of Dr. Harold A. Bell

Lincoln, Nebraska

1964

TITLE

Effects of Radio-Frequency Electrical Fields on the Metabolism

of the Yellow Perch, Lepomis microlophus (L.)

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PREVIEW

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 6. **Identify the main conclusion or result.**
 7. **Identify the main theme or message.**
 8. **Identify the main problem or conflict.**
 9. **Identify the main solution or resolution.**
 10. **Identify the main cause or effect.**

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1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

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INTRODUCTION

During the past four decades extensive studies have been made of the biological effects of various types of electromagnetic energy. Electromagnetic energy includes a wide range of radiation from low-energy radio waves to X rays and gamma rays, which are basically similar in nature. Since the early work of D'Arceval (1895) investigators have provided important information on the effects of electromagnetic energy on living organisms. The need for furthering our knowledge relative to the biological effects produced by various sources of radiation has become increasingly evident.

In an attempt to further the understanding of the action of radio-frequency (RF) electromagnetic energy on living organisms, various investigators studied the mechanism of lethal action of RF treatments on insects. Most researchers concluded that the main cause of death resulted from internal heating. One investigator, however, suggested that a mechanism other than internal heating might be responsible for the cause of death of the treated insects.

The purpose of this investigation was to study the effects of sublethal dosages of continuous and pulsed

modulated RF treatments on yellow mealworm larvae, Tenebrio molitor (L.). The following major objectives were undertaken:

1. to determine the weight loss of insects at various time intervals following exposure to RF treatment
2. to determine whether oxygen consumption of treated insects would increase or decrease in comparison to untreated insects as a measurement of general metabolic disturbance
3. to determine the effect of RF treatments on protein metabolism of the insects by the rate of incorporation of radioactive amino acids and
4. to determine the effect of RF treatments on catabolism of the insects by determining the amount of $C^{14}O_2$ in expired air.

REVIEW OF LITERATURE

The effect of electromagnetic energy on living organisms has been investigated by numerous workers engaged in various branches of biological research since the original observations of P'Arceneval in 1891. In these original observations, P'Arceneval noted a rise in temperature and an increase in metabolism of laboratory animals following exposure to high-frequency electric fields. The utilization of radio-frequency (RF) electric fields as a tool for the possible destruction of insects was first reported by Hendler (1929-1935). Subsequently, numerous papers appeared describing various insect reactions associated with RF treatments. Hendler and Bartlett (1929) observed an increase in the temperature of honey bees killed by RF fields and noted differences in the individual susceptibility of the treated insects. They further noted that adult honeybees were more susceptible to the heating effects of RF electric fields than were the larvae and concluded that such increased susceptibility resulted from the fact that the nervous system is more centralized in the adult honeybees than in the larvae. A determination of the selective heating effects of various substances found in living animals re-

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