**Ain Shams University**
**Faculty of Science**
**Entomology Department**

# Effect of some photosensitizing compounds on the house fly, *Musca domestica* (Muscidae: Diptera) as a control approach

A Thesis
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## ABSTRACT

The effectiveness of three photosensitizing dyes (rose bengal, eosin yellow lactone and methylene blue) was evaluated against adult house fly, *Musca domestica* in the laboratory. As judged by a comparison of $LC_{50}$ values, rose bengal is the most effective dye followed by eosin yellow lactone, then methylene blue. The biochemical effect of the most effective dye, rose bengal was also studied. Results revealed significant changes of the total proteins and total lipids of house fly adults, while no significant difference was observed between the total carbohydrate contents of treated and control samples. Ultrastructure studies showed a drastic effect of rose bengal on most organelles of midgut epithelial cells.



Key words: Photosensitizing dyes, house fly, bioassay, biochemistry, ultrastructure

# I. INTRODUCTION

The house fly (*Musca domestica*) is an important vector for the transmission of several enteric diseases such as dysenteries, infantile diarrhea, food poisoning, cholera and parasitic worm. So, houseflies constitute one of the main human public health problems (Gamal Eddin, 1977). The efficient control of house fly has long been the goal of workers in the field of medical entomology. Chemical treatments create problems by leaving undesirable residues in food. Due to the random use of insecticides and to rapid generation time, flies have developed some level of resistance to most available insecticides, with some insecticides being essentially useless (Kaufman and Rutz, 2002). Thus, it is becoming clear that alternative pest management tools are needed, which will be less hazardous to human, non target organisms and the environment, in the same time these alternative tools must be used in the field application with minimum cost. In this context, sunlight-activated photo-pesticides represent a possible alternative to traditional chemical compounds. The use of photochemical processes as a tool to control the population of several types of insects has been repeatedly examined in both laboratory experiments and field studies on fire ants, *Solenopsis* spp. (David and Heitz, 1978); corn rootworm, *Diabrotica* spp. (Schroder *et al*., 1998), and Mexican fruit fly, *Anastrepha ludens* (Moreno and Mangan, 1995). Moreover, phloxin B, a polyhalogenated fluorescein, has been developed for commercial use as a pesticide (Amor and Jori, 2000).

The mechanism for photodynamic activity has been described by Heitz (1995). Toxicity occurs at the cellular level with the dye acting as a catalyst for the generation of singlet oxygen molecules. The photoactive compound accumulates within the insect and, following exposure to visible light, induces damage of its cuticle, Malpighian tubules, midgut wall, followed by feeding inhibition and eventual death (Amor *et al*., 1998). At the cellular level, most photosensitizers are able to induce apoptotic cell death (Luksiene, 2003 and Eggen *et al*., 2005).

## Plan of work:

1- **Bioassay test**:
   - Determination of the lethal, sub-lethal concentration and lethal time of some photosensitizing compounds on the adult stage.

2- **Biochemical studies:**
   - Quantitative analysis of protein, lipid and carbohydrates and qualitative analysis of protein in adults after treatment with the sub-lethal concentration of the most effective photosensitizing compound.

3- **Histopathological and ultra-structural studies**:
   - Describe the histological and ultra-structural changes in the midgut of adult house fly treated with the sub-lethal concentration of the most effective compound to detect which cellular targets are affected.

# II. LITERATURE REVIEW

## 1- Effect of photosensitizer on insects

**Barbosa and Peter (1970)** tested a series of five concentrations of vital dyes as methylene blue and neutral red for *Aedes aegypti* larvae control. The results showed increasing in mortality and larval period and decreasing in pupation rate. Developmental period of *A. aegypti* larvae treated with neutral red was greater than methylene blue. There was no significant change in male pupal weight treated with methylene blue, although showing a significant difference in case of neutral red. There was a significant difference in female pupal weight treated with both methylene blue and neutral red.

**Yoho *et al*. (1971)** tested seven photoactive dyes on house fly, *Musca domestica* and subsequently exposed to natural and artificial light. Mortality was greatest in flies treated with rose bengal, rhodamine, erythrosin B and eosin blue while little or no mortality occurred in flies treated with uranine, phenosafranin, and methylene blue chloride. Results showed a similarity of results between natural and artificial light. Difference in mortality was observed between dye treated insects exposed to light and those remained in darkness, where 0.0625% rhodamine caused 100% mortality after three hours light and 0% mortality after three hours darkness.

**Yoho *et al*. (1973)** determined the effectiveness of six fluorescent dyes on house fly, *Musca domestica*. They found that rose bengal, erythrosin B, and rhodamine caused the highest mortality then eosin yellow and methylene blue chloride was the lowest. Flies fed a dye