RESEARCH NOTE

EFFECT OF MICROWAVE IRRADIATION ON THE BLOW FLY *CHRYSOMYA MEGACEPHALA* (F.) (DIPTERA: CALLIPHORIDAE)

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Abstract. *Chrysomya megacephala* (F.) is a blow fly species of medical importance, being pestiferous and a mechanical carrier of various microorganisms to human food. Various strategies to reduce the fly population in endemic areas are needed. We investigated the effects of microwaves at 2,450 MHz, with third-instar exposure times of 7, 10, 15, 30 and 60 seconds on the larvae. Survival of the larvae was monitored by their emergence. About 60% of the larvae lived after 7 seconds of exposure, most died by 15 seconds, and all were dead at 30 and 60 seconds. The number of survivals decreased with increasing exposure times. This indicates the effect of microwave irradiation on fly larval survival.

INTRODUCTION

Chrysomya megacephala (F.) is a blow fly species of medical importance, being pestiferous and a mechanical carrier of numerous pathogens to human food, causing disease (Greenberg, 1973). Strategies to control the fly population or delay fly development are needed, particularly in fly endemic areas. Although the use of chemical insecticides remains an essential component in control strategies, *C. megacephala* may develop resistance to them. Some investigators have reported the effects of microwave radiation on insects. Fanslow *et al* (1975) demonstrated that microwave radiation at 2,450 MHz destroys the eggs of the Southern corn rootworm, *Diabrotica undecimpunctata howardi* Barber. Microwave radiation at 460 MHz can delay larval development in the fruit fly, *Drosophila melanogaster* (Meigen) (Bol'shakov *et al*, 2001). There have been no reports on the effects of microwave radiation on the blow fly. This study aimed to determine the effect of microwave irradiation on *C. megacephala*, the most abundant blow fly species in Thailand.

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MATERIALS AND METHODS

The *Chrysomya megacephala* used in this study were obtained from a laboratory colony maintained at the Department of Parasitology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand. The procedure for maintenance has already been described by Sukontason *et al* (2004). Briefly, flies were maintained at ambient temperature (24º-28ºC) and a natural light/dark photoperiod in a cabinet in the rearing room. Adults were reared on two kinds of food: (1) a mixture of 10% (w/v) multivitamin syrup solution and (2) fresh pork liver. The small pieces of fresh pork liver were changed daily. The mixture of 10% sugar solution, mutivitamin syrup and the supplementary food were changed every two days. The oviposition sites were observed daily for the presence of eggs, which if present were transferred to a 12x15x6 cm transparent plastic box, and 40 g of fresh pork liver was provided as larval food. Each box contained 30-40 larvae. A hole, 3/4 the total area of the lid was cut in the lid and covered with fine material for ventilation and the prevention of other small insects entering the box to oviposit in it. The lid

Table 1
Effects of microwave irradiation at 2,450 MHz on *C. megacephala*.

Exposure time in seconds	No. larvae used	No. larvae survived	No. pupae survived	No. adults survived
0 (control)	100	100	100	64
7	100	63	58	48
10	100	29	24	14
15	100	1	1	1
30	100	0	0	0
60	100	0	0	0

was sealed tightly with adhesive tape. The liver was replaced daily until the third instars developed into pre-pupae, during the non-feeding period. Boxes containing pupae were covered and tightly sealed until the emergence of adults, after which the boxes were placed in a rearing cage and the adults were released.

For the experiment, the third instar, the longest period of the fly larval development, was used. The larvae were transferred from the same batch of eggs, and divided into nine groups of 50 larvae per group. Each group was confined to a glass Petri dish, which was covered by a lid and sealed with adhesive paper tape. The Petri dish was placed inside a microwave oven (Sharp®, Japan), which was operated at a frequency of 2,450 MHz, 22 liters, 800 W, and medium heat level. The exposure times for the larvae were set at 7, 10, 15, 30, and 60 seconds, while the control group was not exposed. Each experiment was performed in duplicate. After the exposure period, the number of surviving larvae was recorded. The surviving larvae in each group were monitored for their development to adulthood by transferring them to rearing boxes, with small pieces of fresh pork liver provided as food. Each rearing box was placed in an adult cage. Upon pupation, the pupae of each group were counted. Once emerged, the adults were released to fly in the cage and then counted for survival analysis.

RESULTS

Increasing exposure times resulted in increasing mortality rates. Sixty-three larvae survived when exposed for 7 seconds, almost all of them died after 15 seconds, and all died by 30 and 60 seconds (Table 1). Forty-eight flies survived to adulthood in the group exposed to radiation for 7 seconds. This decreased to 14 adults in the group exposed for 10 seconds. No flies survived when the larvae were exposed for 30 and 60 seconds.

DISCUSSION

Microwaves are a form of electromagnetic energy, produced by a magnetron tube, which converts electricity into high frequency microwaves that penetrate objects in all directions, create friction and produce heat. Microwave radiation can affect living organisms in different ways, and radiation of high intensity is lethal, due to its thermal effect on living tissues (Ondracek *et al,* 1976). When plant or animal tissues that have a high water content, as in the blow fly (Chapman, 1982), make contact with microwave radiation, their water molecules react to the friction and cause rapid ripping of the tissue. In this study, as expected, more blow fly larvae died with longer periods of microwave radiation. Our results are similar to those of another study (Fanslow *et al*, 1975) which studied the effects of microwave radiation (2,450 MHz) on the eggs of *D. howardi*. Low-frequency pulse-modulated 460 MHz electromagnetic irradiation of *D. melanogaster* embryos can induce some alterations, such as imago legs and wings (Bol'shakov *et al*, 1996) or interrupt development (Bol'shakov *et al*, 2001).

The practical use of microwave radiation for the control of the blow fly *C. megacephala* merits further investigations.

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