The efficacy of sulfuryl fluoride against egg stage of the dried fruit beetle

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ABSTRACT

The toxicity of sulfuryl fluoride (SF) at various concentration levels against the egg stage of *Carpophilus hemipterus* (L.) (Coleoptera: Carpophylidae) was evaluated at 15, 20, 25^{o}C and 75% RH over 24 h exposure period. Studies were conducted using 0-24 and 24-48 h old eggs of *Carpophilus hemipterus* in vacuum desiccators of 28.3-L capacity (Labconco®)

According to results, 0-24 h old eggs were more tolerant to SF than 24-48 h old eggs. At 25^{o}C, complete mortalities of 0-24 and 24-48 h old eggs were obtained at 180 and 80 gm^{-3} SF, respectively. Increase in temperature increased the egg mortality. Thus, mortality rates of 0-24 h old eggs exposed to SF at180 gm^{-3} at 15, 20 and 25^{o}C were calculated as 56.5%, 91.1%, and 100%, respectively.

Key words: *Carpophilus hemipterus*, sulfuryl fluoride, egg mortality

INTRODUCTION

Nitidulid beetles are economically important pests of dried figs in western Aegean region of Turkey. They attack live fruits in the orchards and in storage and can also vector aflatoxin-producing fungi (Sen et al., 2010). In a previous study, infestation rate of *Carpophilus* spp. in dried fig orchards was reported as up to 25.8% (Turanli, 2003). In Turkey, dried figs were fumigated with methyl bromide (MB) until its ban in 2004. Alternative pest control options are of top importance for Turkey who performed 60 to 75% of the worldwide dried fig production. Currently there is no alternative fumigant in use that completely replaces MB in dried figs. Thus, the aim of this study was to evaluate the effectiveness of SF as an alternative to MB on the dried fruit beetle. Fumigation tests were performed using egg stage since eggs of many insect pest species have been reported as the most tolerant stage to SF (Bell and Savvidou, 1999; Su and Scheffrahn 1990; Baltaci et al., 2009)

MATERIALS AND METHODS

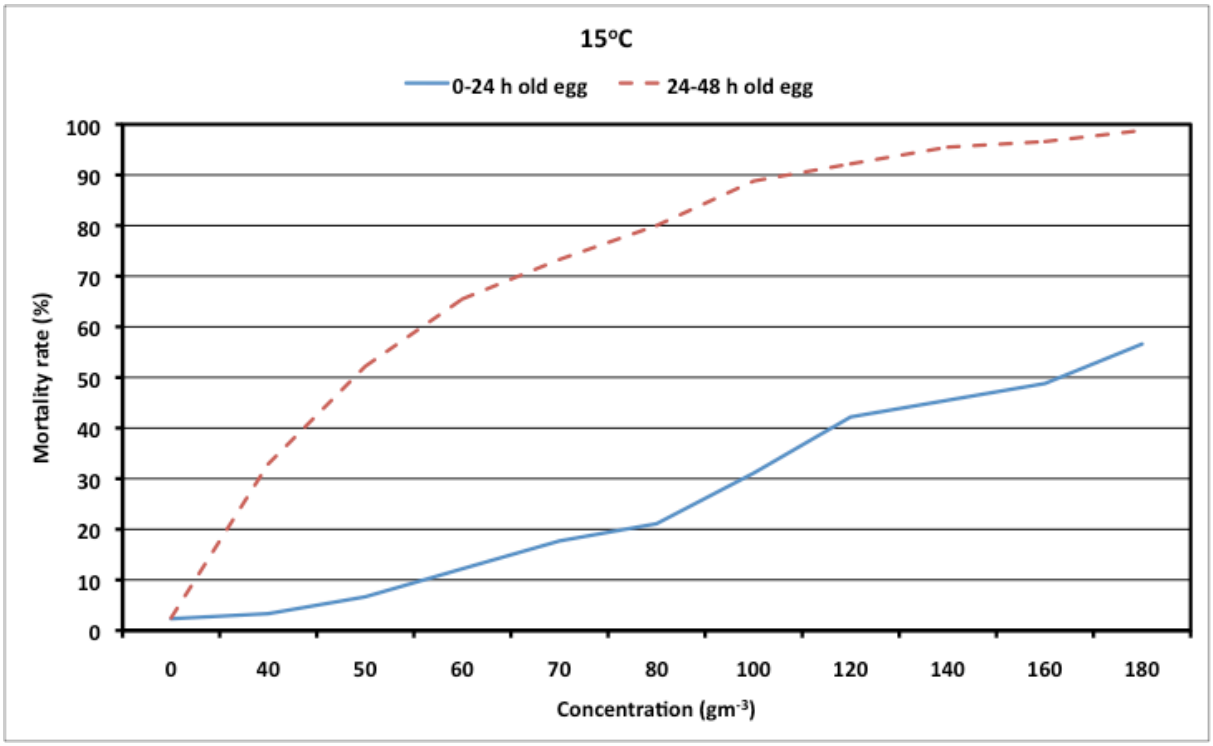
The efficacy of SF at different concentrations were evaluated on the egg of *Carpophilus hemipterus* (L.) (Coleoptera: Carpophylidae) at the three temperatures of 15, 20, and 25^{o}C in vacuum desiccators of 28.3-L capacity (Labconco®) over 24 h exposure time.

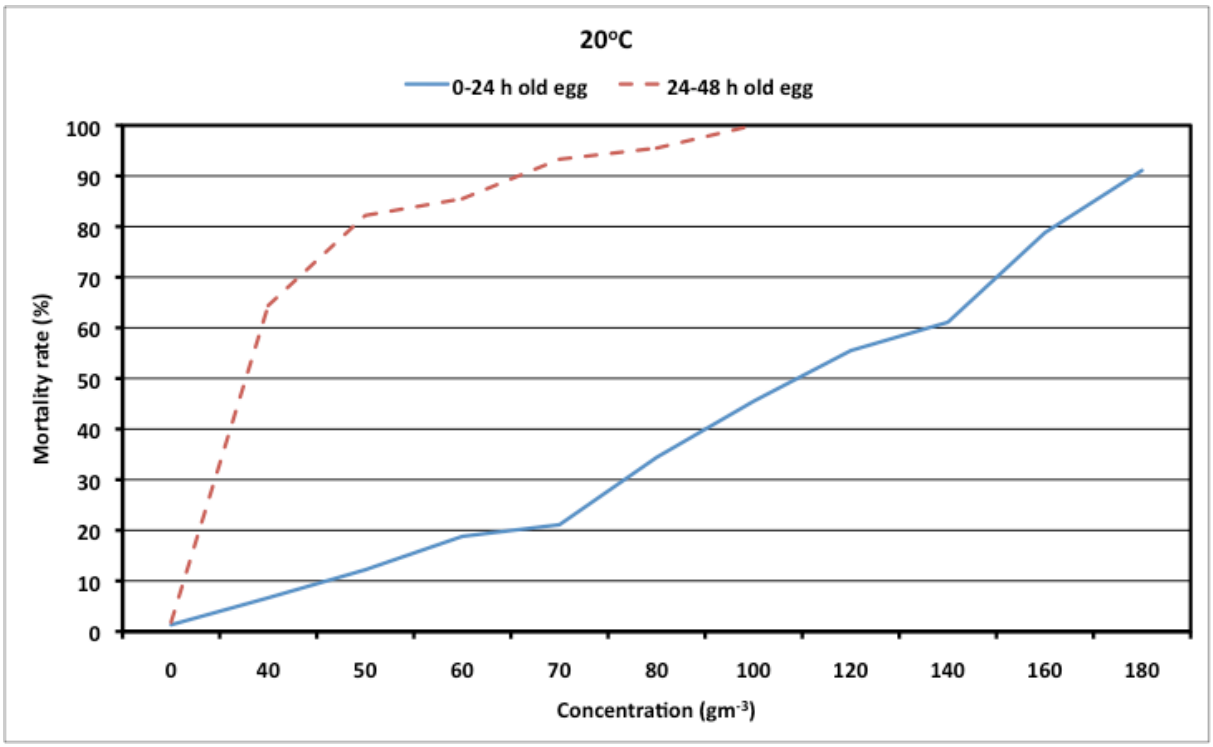
Studies were conducted using 0-24 and 24-48 h-old eggs of the dried fruit beetle. Eggs were exposed to SF concentrations in specially designed plexiglass plates having small pits to individually house the eggs. The fumigation chambers were equipped with circulation fans. SF concentrations introduced into the chambers using a gastight mega syringe were determined at the beginning and at the end of the exposure period using portable gas measuring equipment (Fumiscope version 5). After the exposure, each plexiglass plate was covered with a glass coverslip of 15*20 cm, and kept in controlled room at 25°C and 75% RH. Egg hatching was checked daily using a stereoscopic binocular microscope until there was no more emergence.

RESULTS AND DISCUSSION

The toxicity of SF on 0-24, 24-48 and 48-72 h old eggs of *C. hemipterus* at 15, 20, and 25^{o}C is shown in Figure 1. Results showed that the susceptibility of eggs of *C. hemipterus* to SF varied according to age. 0-24 h old eggs of *C. hemipterus* seem more tolerant than 24-48 h old eggs at all the temperatures tested. Similarly, Bell et al. (1999) reported that the 3-day-old eggs of *Ephestia kuehniella* (Zeller) (Lepidoptera: Pyralidae) were more susceptible than the other egg stages. On contrary to our findings, Baltaci et al (2009) suggested that 1-day-old eggs of *Ephestia elutella* (Hübner) (Lepidoptera: Pyralidae) were most susceptible to SF at 15, 20, and 25^{o}C temperatures.

Complete mortality of the egg stage of *C. hemipterus* was achieved at 180gm^{-3} SF for 24 h exposure at 25^{o}C. At the same temperature, Baltaci et al (2009) reported that a complete mortality of 1–4-day-old *E. elutella* eggs were obtained after 24 h exposure to SF at 21.3 gm^{-3}


15°C
0-24 h old egg
24-48 h old egg
Mortality rate (%)
100
90
80
70
60
50
40
30
20
10
0
0
40
50
60
70
80
100
120
140
160
180
Concentration (gm-3)


20°C
0-24 h old egg
24-48 h old egg
Mortality rate (%)
100
90
80
70
60
50
40
30
20
10
0
0
40
50
60
70
80
100
120
140
160
180
Concentration (gm-3)

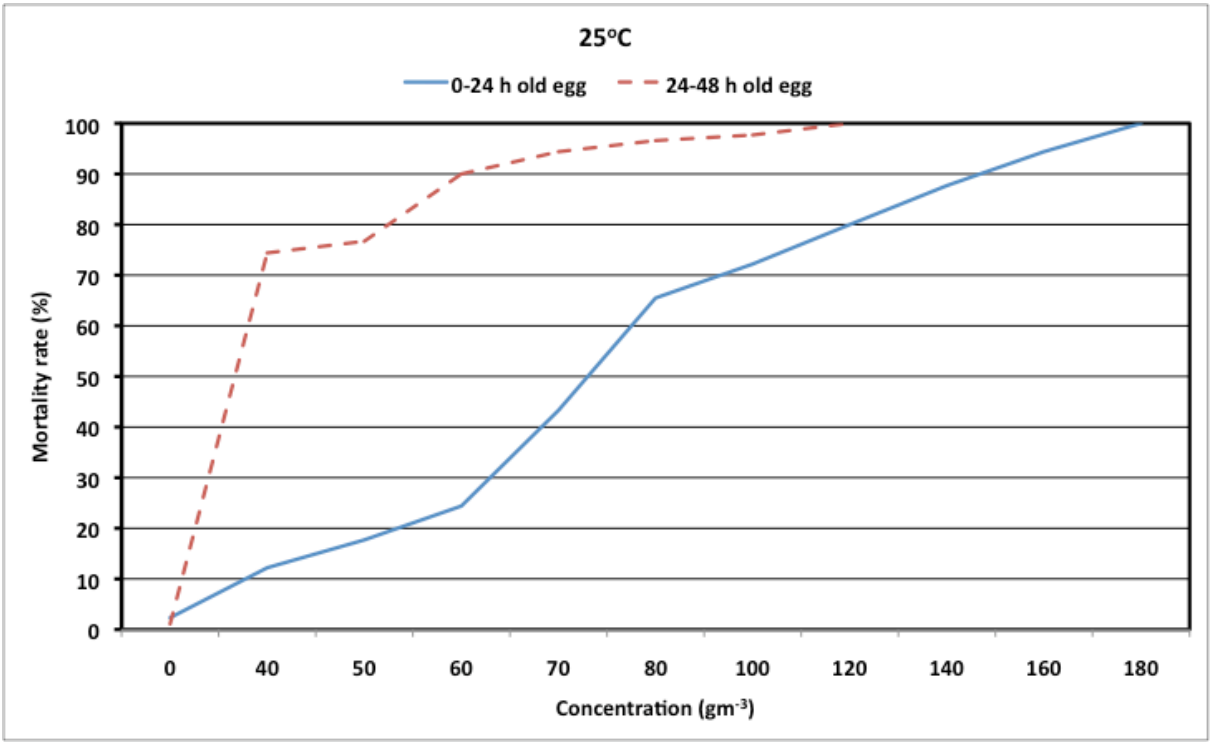


Figure 1. Mortality of 0-24 and 24-48 h old eggs of *Carpophilus hemipterus* exposed to sulfuryl fluoride at different concentrations over 24 h exposure period at 15, 20, 25°C and 75% RH.

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