DISINFESTATION OF NITIDULID BEETLES FROM DRIED FRUITS BY MODIFIED ATMOSPHERES

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Abstract

Among the important pests of dried fruits are nitidulid beetles. Infestation starts in the field and unless control measures are employed, they and other pests continue to multiply and develop during storage. Methyl bromide (MB) has been used for fumigating dried fruits. However, because it is associated with the depletion of the atmospheric ozone, action has been taken to phase out its use in agriculture. This work was undertaken to develop a modified atmosphere treatment which would remove insects from the dried fruit. Dates grown in Israel served as a model for development of the technology.

Laboratory experiments were carried out to investigate the influence of different modified atmospheres (20% carbon dioxide in air or 2.8% oxygen in nitrogen), low pressures alone or MB alone in causing Nitidulid beetles to emigrate from infested dried dates. At 4 h exposure and at 26^{0}C, the treatments that had a marked influence in causing insects to abandon the infested fruit were: low pressure of 100 mm Hg and 2.8% oxygen in nitrogen, both of which caused over 80% of the initial insect populations to emigrate from the fruit.

Keywords: Nitidulid beetles, dried fruits, modified atmospheres.

INTRODUCTION

Dried fruits are subject to infestation by insect pests during and after harvest. Several species of nitidulid beetles are particularly associated with dried fruits because they are field and storage pests. Fumigation of dried fruits with methyl bromide (MB) upon arrival at the packing plant effectively controls infestation and also causes a high proportion of larvae and adults to emigrate from the fruit before they succumb. The mechanism of this emigration is not clear. MB has a delayed action on insects which is different from other fumigants that have an anesthetic effect and are termed indifferent narcotics.

The influence of different controlled atmospheres (CA's) in causing emigration of *Carpophilus* **spp. larvae from dates was compared with that of MB. Recommended dosages for mortality of most stored product pests using CA are >60% carbon dioxide for at least 11 days exposure. The influence of low O_2 or high CO_2 atmospheres as alternatives to fumigation of dried fruits has been investigated.**

Emigration from infested fruit is no less important than the toxic effect of the treatment because established tolerances set minimum acceptance levels for the presence of both dead and live insects.

In this study the effectiveness of a number of treatments and methyl bromide in causing emigration of *Carpophilus* **spp. larvae from dates was compared.**

MATERIALS AND METHODS

Test insects consisted of larvae of *Carpophilus hemipterus* **(L.) and** *C. mutilatus* **Erichson which were reared on media described by Donahaye and Navarro (1989). Infested dates were exposed to different treatments in 2.54 L desiccators. Each treatment was exposed**

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for 4 h. The first treatment consisted of a dose of 16 mg/L methyl bromide. The second treatment consisted of a 20% concentration of carbon dioxide (CO_2) in air. The third treatment was a low pressure of 100 mm Hg. The fourth treatment was an atmosphere of 2.8% oxygen (O_2) in nitrogen. The final treatment and control was ambient air at atmospheric pressure and 26±1°C. During exposure the desiccators were held in the dark at 26±1°C and 75±5% RH. The proportion of insects found outside the dates was used to measure response.

RESULTS AND DISCUSSION

The influence of different treatments on emigration from artificially infested dates is shown in Fig. 1. Analysis of variance showed that differences in levels of emigration between treatments were highly significant ($F = 167.822$; df = 4; $P = 0.00$).

Fig. 1- Comparison of the influence of methyl bromide (MB) (16 mg/L), low atmospheric pressure (100 mm Hg), 2.8% oxygen (O_2), and carbon dioxide (CO_2) on the disinfestation of artificially infested dates after 4 h of exposure at 26°C. Emigration rates assigned a common letter do not differ significantly at $P < 0.05$ (Navarro *et al.*, 1989).

Emigration under the influence of MB, low atmospheric pressure, and low O_2 concentration were similar for the treatments. Results of these treatments differ significantly from the control and the CO_2 treated groups. The *Carpophilus* **larvae appear to seek out and penetrate their food substrate through cracks and crevices and then remain largely sedentary, thus creating a niche in which they feed until they begin to wander prior to pupation. Premature emigration from the feeding sites takes place under exposure to MB, low pressures, and low O_2 concentration. These treatments place the larva under stress, which interrupts feeding and causes them to wander. The similarity in the response of insects in the artificially infested dates demonstrate the validity of using these treatments.**

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A common characteristic of all the treatments tested in the present work is their capacity to cause eventual mortality, depending on the length of exposure. The modified atmosphere and low pressure treatments at the tested exposure periods in this study are known to permit high levels of insect survival, and only exposure times considerably longer than 24 h would cause mortality.

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