

# A Preliminary Study on the Fumigant Toxicity of Essential Oils to Eggs and Larvae of Queensland Fruit Fly *Bactrocera tryoni*

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**Keywords:** *Eucalyptus citriodora*, *Eucalyptus staigeriana*, *Eucalyptus radiata*, *Eucalyptus dives*, *Leptospermum petersonii*, *Mentha piperita*, *Melaleuca teretifolia*, *Citrus limon*

## Abstract

Essential oils are often used in daily lives of human food as flavours, fragrances, in alternative medicine, as antiseptics and mosquito repellents. The aim of this study was to evaluate the fumigant toxicity of eight essential oils (*Eucalyptus citriodora*, *Eucalyptus staigeriana*, *Eucalyptus radiata*, *Eucalyptus dives*, *Leptospermum petersonii*, *Mentha piperita*, *Melaleuca teretifolia* and *Citrus limon*) against eggs and larvae of Queensland fruit fly *Bactrocera tryoni* (Froggatt). Forty eggs were exposed to each essential oil at a dose of 100 µl/L air for 6 and 24 h in a fumigation chamber. After treatment, the treated and control eggs were transferred to petri dishes containing carrot-based diet. The fumigant toxicity of the essential oils was tested also against the first, second and third instars. Twenty larvae of each instar were placed in carrot-based diet and exposed to each essential oil at a dose of 100 µl/L air for 24 h. The results of a 24-h exposure test showed that essential oil of *M. piperita* had strong fumigant effect on eggs, reducing the hatching to 3.8% in treated eggs compared to untreated 91.9%. However, the same *M. piperita* essential oil showed low fumigant effect against the larval stages. Essential oil of *E. dives* showed low fumigant effect against eggs but it showed strong fumigant effect on the first and second instars. From 20 larvae exposed to *E. dives* essential oil, of the first instars only 10% reached the pupal stage and of the second instars only 3.8% pupated compared with 95.0% and 98.8% in each control. None of the tested essential oils showed fumigant effects on third instars. Results indicate that *E. dives* and *M. piperita* essential oils merit further investigation for their potential as fumigants against early instars and eggs of Queensland fruit fly.

## INTRODUCTION

Essential oils are often used in human food as flavours and fragrances and in alternative medicines as antiseptics and mosquito repellents. Furthermore, these oils have been reported to have various lethal and sub lethal effects on many agricultural pests (Regnault-Roger et al., 2012; Isman, 2000). The toxic effects of essential oils to arthropods can occur through contact, ingestion or inhalation of the oils.

Essential oils mainly consisted of volatile compounds so that they are more likely to have fumigant toxicity on insects compared to other plant derivatives. The fumigant toxicity of essential oils has been shown against many postharvest pests especially beetles such as *Callosobruchus maculatus* (Fabricius), *Rhyzopertha dominica* (Fabricius), *Sitophilus zeamais* Motschulsky, *Sitophilus oryzae* (Linnaeus) and *Tribolium castaneum* (Herbst) (Perez et al., 2010; Rajendran and Sriranjini, 2008). In addition, they have fumigant effects on a number of preharvest plant pests such as aphids (Kimbaris et al., 2010), thrips (Yi et al., 2006), whiteflies (Kim et al., 2011) and mites (Han et al., 2011).

Essential oils have been found also to have fumigant effects on the adult stages of tephritid fruit fly species i.e., *Ceratitis capitata* (Wiedemann), *Bactrocera dorsalis*

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