



## Residual contact toxicity and repellence of *Cupressus lusitanica* Miller and *Eucalyptus saligna* Smith essential oils against major stored product insect pests



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### ARTICLE INFO

#### Keywords:

*Cupressus lusitanica*

Essential oil

*Eucalyptus saligna*

Insect pest

Mortality

Repellence

### ABSTRACT

In an effort to find eco-friendly alternatives to synthetic pesticides in grain storage, residual contact toxicity and repellence of *Cupressus lusitanica* and *Eucalyptus saligna* leaf essential oils were evaluated against adult *Tribolium castaneum*, *Acanthoscelides obtectus* and *Sitophilus zeamais*. In bioassays, oil was applied at 0.00, 0.05, 0.10, 0.15 and 0.20% v/w to wheat and bean grains and stored for 30–120 days after which test insects were introduced into sub-samples of treated grains. Both oils at 0.20% v/w and 120 days grain storage duration caused a mortality of 5.0–65.0% in test insects whereas in the repellence bioassay, at same doses and grain storage duration produced percent repellence values of 34–52.4% of test insects. Considering other pesticidal properties of *C. lusitanica* and *E. saligna* oils, current results point oils as potential residual contact toxicants and repellents for possible integration into insect pest management practices.

### 1. Introduction

Insect pests cause 5–10 and 20–30% damage to stored grains in the temperate and tropical countries, respectively (Philips and Throne, 2010). Post-harvest losses can include not only loss of the crop itself, but also lack of return on the resources needed to produce the crop, and a decrease in the livelihood of individuals involved in the production process (Bett, 2015). In addition, stored product pests also contaminate milled grains including presence of insect fragments in flour (Campolo et al., 2012). Several species of insects attributed to these losses and identified as the major insect pests of stored cereal and legume grains globally include, maize weevil, *Sitophilus zeamais* Motch. (Coleoptera: Curculionidae), Angoumois grain moth, *Sitotroga cerealella* Olivier (Lepidoptera: Gelechiidae), bostrichid beetles, *Prostephanus truncatus* Horn and *Rhyzopertha dominica* F. (Coleoptera: Bostrichidae), bean bruchid, *Acanthoscelides obtectus* Say (Coleoptera: Bruchidae), cowpea beetles, *Callosobruchus chinensis* F. (Coleoptera: Chrysomelidae), the rust-red flour beetle *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae) (Rajendran and Sriranjini, 2008; Deng et al., 2009; Nukenine, 2010;

Ogendo et al., 2012; Bett, 2015).

The bean bruchid, *A. obtectus*, together with cowpea beetles (*C. chinensis* and *C. maculatus*) are destructors of stored legume grains. The bean bruchid is a major pest of beans in temperate to subtropical regions worldwide. The potential damage to stored grains by this pest is great owing to its ability to infest grains both pre- and post-harvest, and several larvae can develop in one seed (Ogendo et al., 2012; Bett et al., 2016). *Sitophilus zeamais* larvae damage maize crops by developing within an individual grain, eating it away from the inside out until it matures, and then reproducing, releasing more crop-damaging larvae. The maize weevil is a danger to both growing standing crops and stored maize (Ogendo et al., 2012). On the other hand, *T. castaneum* is a cosmopolitan stored product insect pest that can be found in warehouses, pet food stores, and grain processing facilities such as rice and flour mills. It is considered a secondary insect pest species and is frequently one of the least susceptible stored product beetle pest species to insecticides (Bett et al., 2016).

Stored product insect pest control is based mainly on the use of highly effective synthetic fumigants and contact toxicants. However,

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