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Fumigant toxic potential of *Ruta graveolens* essential oil and its 2-methlyl ketone constituents on the eggs of *Corcyra cephalonica*

A. G. W. U. Perera[1]*, M. M. S. C. Karunaratne[1] and S. D. M. Chinthaka[2]

[1]Department of Zoology, [2]Department of Chemistry,
University of Sri Jayewardenepura, Sri Lanka
**Email: wathsalauda@gmail.com*

Essential oils, emanated from plants, constitute effective alternatives to the use of synthetic pesticides thus holding an extraordinary promise on insect pest control, primarily because of their easy extractability, catabolization in the environment, zero persistency in environment, low toxicity against vertebrates, important role in plant protection against pests and the less stringent regulatory approval mechanisms for their exploration due to the long history of their multipurpose uses in perfumery, pharmaceutical and other industries. In this sense, present study was undertaken with a view to explore the possibilities of using volatiles emanating from the essential oils extracted from the leaves of *Ruta graveolens* by hydro-distillation through Clevenger's apparatus, on egg hatchability of *Corcyra cephalonica*. Fumigant insecticidal effects of *R. graveolens* essential oil and its 2-methyl ketones of 2-octanone, 2-nonanone, 2-decanone, 2-undecanone, 2-dodecanone and 2-tridecanone, were evaluated against the freshly laid eggs of *C. cephalonica* for various exposure time durations (6 hrs, 12 hrs and 24 hrs) with different authentic concentrations in space fumigation at 29 ± 2^0C and 84 ± 2% RH, under dark condition. Fumigant toxic effects of the oil and its constituents on the egg hatchability were significantly (p<0.001) influenced by concentration and the exposure time period. An increase in the susceptibility of the eggs was observed as the concentrations of the oils and its ketones were increased. Accordingly, a marked reduction in egg hatchability was observed with the increase in the exposure time period to the vapors of the essential oil and its constituents. Essential oil of *R. graveolens* at the concentration of 135.87 µl/l air and the even-chained congeners at the corresponding authentic concentrations (0.60 - 2.99 µl/l air) achieved 100% inhibition of hatching whilst odd-chained congeners of 2-nonanone, 2-undecanone and 2-tridecanone producing the respective levels of 35, 8 and 12% egg hatchability at the corresponding authentic concentrations (1.09 - 30.82 µl/l air) after the 24 hr exposure period. Eggs were significantly more susceptible to even-chained congeners (LC_{50}= 0.023 – 0.98 µl/l air) than the odd-chained congeners (LC_{50}= 0.056 – 5.583 µl/l air) whereas the latter of which was followed by the essential oil with estimated LC_{50} value of 6.393 µl/l air. Present study suggests that the *R. graveolens* essential oil and its 2-methyl ketone analogues could be exploited as potential alternatives to synthetic fumigants in the treatment of durable agricultural products. In that context, the modus operandi of such control linked with olfaction needs more research and successful adoption of plant oils and its aromatic constituents in the protection of stored food commodities which promises a biorational option compatible with international eco-safety regulations.

Keywords: *Corcyra cephalonica*, Fumigant, 2-methyl ketones, *Ruta graveolens*

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