BIOLAVICIN

Biolarvicide from *Cinnamomum burmannii* Against *Aedes aegypti* Larvae

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1. Introduction

Dengue hemorrhagic fever is a major health problem in Indonesia. One of the methods to prevent this disease is by controlling *Ae. aegypti* larvae. All this time, temephos has been used for this purpose, but after a long period it can cause mosquito's larval resistance and cause adverse effects to the environment [1]. *Cinnamomum burmannii* is an endemic cinnamon in Indonesia [2]. Based on our Gas Chromatography Mass Spectrometry (GCMS) analysis, essential oil of *C. burmannii* bark contains about 33% of cinnamaldehyde. Cinnamaldehyde is a widely known natural insecticide, therefore potentially cinnamon can be used as a biolarvacide.

2. Research Method

This research was an experimental study**,** consisting of GCMS analysis of *C. burmannii* essential oil, preliminary experiment, larvicide experiment using WHO guidelines [3], and microscopic study. Essential oil was mixed with ethanol 70% to increase its solubility in water and be exposed to *Ae. aegypti* 3rd and 4th instars larvae in various concentrations based on the preliminary experiment. The tests were replicated three times. After 24 hours and 48 hours of biolarvicide exposure, larval mortality was counted. The concentrations that cause Lethal Concentration of 50% larvae (LC_{50}) and 90% larvae (LC_{90}) were set by Probit analysis. We observed the morphology of dead larvae that was exposed to biolarvicide by binocular microscope. Their morphology was compared to the unexposed larvae.

3. Results and Analysis

The percentages of *Ae. aegypti* 3rd instar larval mortality after 24 hours and 48 hours of biolarvicide exposure were shown on Figure 1.

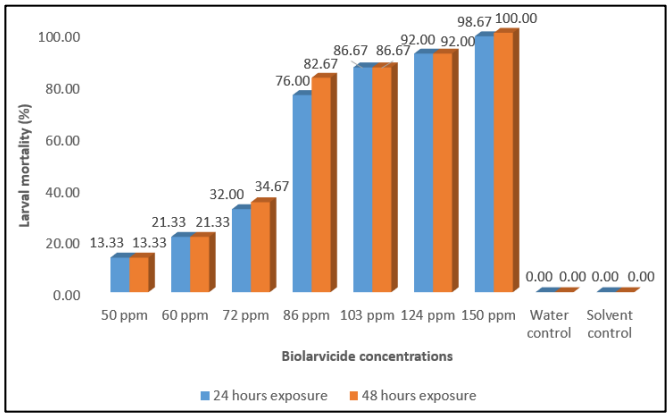

Figure 1. Percentages of *Ae. aegypti* 3rd instar larval mortality after 24 hours and 48 hours.

The percentages of *Ae. aegypti* 4th instar larval mortality after 24 hours and 48 hours of biolarvicide exposure were shown on Figure 2.

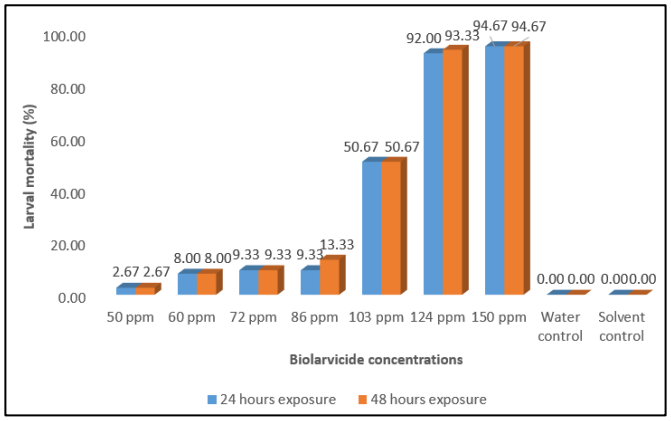

Figure 2. Percentages of *Ae. aegypti* 4th instar larval mortality after 24 hours and 48 hours.

Figure 1 and 2 revealed that increasing biolarvicide concentration would increase larval mortality. Meanwhile, there was no larval mortality on the controls. There was no significant difference between 24 hours and 48 hours exposure. Based on student t-test, the T-value for *Ae. aegypti* 3rd instar larvae was -0.08 while for *Ae. aegypti* 4th instar larvae was -0.03 after 24 and 48 hours exposure, respectively. Using Probit analysis, it was found that after 24 hours exposure, LC_{50} and LC_{90} for *Ae. aegypti* 3rd instar larvae were 78 ppm and 110 ppm, respectively. While after 48 hours exposure, LC_{50}

and LC_{90} for LC_{90} for 3rd instar *Ae. aegypti* were 77 ppm and 108 ppm, respectively.

Meanwhile, after 24 hours exposure, LC_{50} and LC_{90} for *Ae. aegypti* 4th instar larvae were 103 ppm and 134 ppm, respectively. While after 48 hours exposure, LC_{50} and LC_{90} for *Ae. aegypti* 4th instar larvae were 102 ppm and 133 ppm, respectively.

On microscopic study, we found some morphological damages on larvae due to biolarvicide exposure, such as thorax shrinking, spiracle trachea disintegrated, outer membrane depletion, and siphon swelling as shown in figure 5 and 6.

Figure 5. Microscopic anterior view of *Ae. aegypti* 4th instar larvae with 4×0,10 magnification

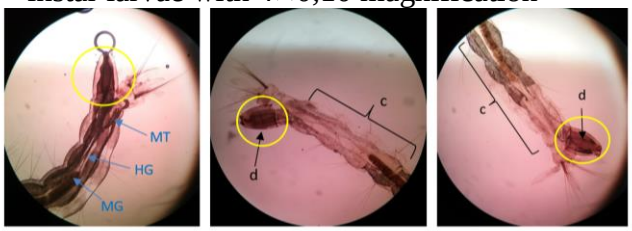

Figure 6. Microscopic posterior view of *Ae. aegypti* 4th instar larvae with 4×0,10 magnification

ST = spiracle trachea
FG = foregut
MG = midgut
HG = hindgut
MT = malphigian tubules
a = thorax shrinking
b = spiracle trachea disintegrated
c = outer membrane depletion
d = siphon swelling

4. Conclusion

It was concluded that essential oil of *C. burmannii* can act as an effective biolarvicide against *Ae. aegypti* larvae.

5. References

[1] Wijaya, L. A. 2009. *Daya Bunuh Ekstrak Biji Kecubung (Datura metel) terhadap Larva Aedes aegypti*. Fakultas Kedokteran UNS, Surakarta. pages 1 – 35.

[2] Pratiwi, Narendra, B. H., Hartoyo, G. M. E., Kalima, T., dan Pradjadinata, S. 2014. *Atlas Jenis-jenis Pohon Andalan Setempat untuk Rehabilitasi Hutan dan Lahan di Indonesia*. Bogor: Forda.

[3] World Health Organization. 2005. *Guidelines for Laboratory and Field Testing of Mosquito Larvicides*.WHO/CDS/WHOPES/GCDPP/2005 Geneva: WHO. page 69.