NANOEMULSION OF MIXTURE *Piper aduncum* ESSENTIAL OIL AND FRAGRANT *Cymbopogon nardus* DISTILLED WASTE AND *Bacillus thuringiensis* STRAIN MRSNR3.1 TO CONTROL BACTERIAL LEAF BLIGHT ON SHALLOT (*Xanthomonas axonopodis* pv. *allii*)

THESIS

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ABSTRACT

The bacterial species *Xanthomonas axonopodis* pv. *allii* (Xaa) is an important pathogen causing the leaf blight in shallots. This pathogen is known to be easily resistant to synthetic pesticides. Therefore, the use of botanical pesticides with nanoemulsion formulations has become a suitable alternative. The objective of the research was to obtain nanoemulsion from mixture of *Piper aduncum* essential oil and fragrant *Cymbopogon nardus* waste, thereby finding the optimal concentration to suppress Xaa growth while testing *Bacillus thuringiensis* strain MRSNR3.1 and its secondary metabolites toxicity against Xaa was carried out by the diffusion method using paper discs to determine the diameter of the inhibition zone was carried out in vitro. The results demonstrated that at a concentration of 1% (3.17 cm in diameter) of the nanoemulsion after 4 days of incubation, the inhibitory effect was higher than that of the concentration of 2.5 %, 5% and 7%, additionally, *B. thuringiensis* strain MRSNR3.1 (3.04 ± 0.44) and its secondary metabolites (2.21 ± 0.28) were both able to control Xaa. To determine the activity of peroxidase, polyphenol oxidase and phenylalanine ammonia lyase enzymes in shallots was performed by introducing nanoemulsion, *B. thuringiensis* strain MRSNR3.1 and bactericide of Streptomycin. The results showed that *B. thuringiensis* strain MRSNR3.1 had the highest activity in the roots and leaves of shallot on the three enzymes mentioned above. It can be seen that the induction of *B. thuringiensis* strain MRSNR3.1 increased the defense enzymes PO, PPO, PAL to the highest.

Key words: Nanoemulsion, Peroxidase, Phenylalanine Ammonia Lyase, Polyphenol oxidase, *Xanthomonas axonopodis* pv. *allii*.