

ABSTRAK

EVALUASI *IN SILICO* DAN *IN VITRO* MINYAK ATSIRI BIJI JARAK KEPYAR (*Ricinus communis* L.) TERHADAP *Fusarium* sp. PATOGEN LAYU CABAI RAWIT (*Capsicum frutescens* L.)

Oleh

Gipar Ramdani

NPM 215001507

Dosen Pembimbing:

Darul Zumani

Yanto Yulianto

Penyakit layu *Fusarium* merupakan salah satu masalah utama pada tanaman cabai rawit (*Capsicum frutescens* L.) yang disebabkan oleh cendawan *Fusarium* sp., dan dapat menurunkan kualitas serta kuantitas hasil panen. Penelitian ini bertujuan untuk mengevaluasi potensi minyak atsiri biji jarak kepyar (*Ricinus communis* L.) sebagai biofungisida dalam menghambat pertumbuhan *Fusarium* sp. melalui pendekatan *in silico* dan *in vitro*. Metode *in silico* dilakukan menggunakan teknik *molecular docking* antara senyawa aktif yang terkandung dalam minyak atsiri biji jarak kepyar dengan protein target *1,3-β-glucan synthase*. Sementara itu, uji *in vitro* dilakukan dengan mengamati pertumbuhan koloni cendawan pada media PDA yang diberi perlakuan minyak atsiri biji jarak kepyar pada konsentrasi 3%, 4%, dan 5%. Hasil *docking* menunjukkan bahwa senyawa aktif N-acetyltyramine dan Phenol, 4-(2-aminoethyl)-(tryamine) memiliki nilai afinitas tertinggi terhadap protein *1,3-β-glucan synthase* masing-masing -6,3 kcal/mol dan -5,5 kcal/mol dengan nilai RMSD 0,000 Å, Pola interaksi didominasi kombinasi ikatan hidrogen (GLN631, HIS635) dan hidrofobik (TRP439). Sementara itu, hasil uji *in vitro* menunjukkan bahwa konsentrasi 5% minyak atsiri biji jarak kepyar memberikan daya hambat tertinggi terhadap pertumbuhan koloni *Fusarium* sp., yaitu sebesar 33,02% pada 7 HSI. Berdasarkan temuan tersebut, minyak atsiri biji jarak kepyar berpotensi digunakan sebagai agen antijamur alami untuk mengendalikan penyakit layu *Fusarium* pada tanaman cabai rawit.

Kata kunci: Cabai rawit, *Fusarium* sp., *in vitro*, minyak atsiri, *molecular docking*

ABSTRACT
IN SILICO AND IN VITRO EVALUATION OF CASTOR SEED
(*Ricinus communis* L.) ESSENTIAL OIL AGAINST *Fusarium* sp., THE
PATHOGEN CAUSING WILT DISEASE IN CHILI PEPPER
(*Capsicum frutescens* L.)

By

Gipar Ramdani
NPM 215001507

Supervisor:
Darul Zumani
Yanto Yulianto

Fusarium wilt is one of the major diseases affecting chili pepper (*Capsicum frutescens* L.), caused by the fungus *Fusarium* sp., which can significantly reduce both the quality and quantity of crop yields. This study aimed to evaluate the potential of castor seed (*Ricinus communis* L.) essential oil as a biofungicide to inhibit the growth of *Fusarium* sp. through *in silico* and *in vitro* approaches. The *in silico* method was conducted using molecular docking techniques between the active compounds found in castor seed essential oil and the target protein *1,3-β-glucan synthase*. Meanwhile, the *in vitro* test was performed by observing fungal colony growth on PDA media treated with castor seed essential oil at concentrations of 3%, 4%, and 5%. The docking results showed that the active compounds N-acetyltyramine and Phenol, 4-(2-aminoethyl)-(tryamine) exhibited the highest affinity for the *1,3-β-glucan synthase* protein, with binding energies of -6.3 kcal/mol and -5.5 kcal/mol, respectively, and an RMSD value of 0.000 Å. The interaction pattern is dominated by a combination of hydrogen bonds (GLN631, HIS635) and hydrophobic interactions (TRP439). Furthermore, the *in vitro* results revealed that the 5% concentration of castor seed essential oil provided the highest inhibition rate against *Fusarium* sp. colony growth, reaching 33.02% at 7 days after inoculation (DAI). Based on these findings, castor seed essential oil shows potential as a natural antifungal agent for controlling *Fusarium* wilt disease in chili pepper plants.

Keywords: Chili pepper, essential oil, *Fusarium* sp., *in vitro*, molecular docking