

TESIS

**AKTIVITAS JAMUR ENTOMOPATOGEN ENDOFIT PADA
Spodoptera frugiperda YANG DIBIAKAN PADA PAKAN
BUATAN DAN POTENSI JAMUR DALAM MENINGKATKAN
PERTUMBUHAN JAGUNG**

***ACTIVITY OF ENDOPHYTIC ENTOMOPATHOGEN FUNGUS
ON *Spodoptera frugiperda* CULTIVATED ON ARTIFICIAL FOOD
AND THE POTENTIAL OF THE FUNGUS IN INCREASING
CORN GROWTH***



**Dellania Eka Rindiani
05012682226003**

**PROGRAM STUDI ILMU TANAMAN
FAKULTAS PERTANIAN PROGRAM STUDI
PASCASARJANA
UNIVERSITAS SRIWIJAYA
2024**

SUMMARY

DELLANIA EKA RINDIANI, Activity of Endophytic Entomopathogen Fungi on *Spodoptera frugiperda* Cultivated on Artificial Feed and the Potential of Fungi in Increasing Corn Growth (Supervised by **SITI HERLINDA** and **SUWANDI**)

Spodoptera frugiperda (FAW) (Lipidoptera: Noctuidae) is a new pest and is the main pest of corn crops in Indonesia. *S. frugiperda* larvae only come out in the morning to look for food and the rest of the time hide in the rolls of young corn leaves so that endophytic entomopathogenic fungi are needed for effective, efficient and environmentally friendly sustainable management. In addition, on a laboratory scale, multiplication of test insects using artificial feed was also carried out. This research aims to determine the effect of providing seven types of butane feed from wild plants on the growth and development of *S. frugiperda*, to determine the effect of corn inoculated with endophytic fungi by seed treatment on the growth and development of *S. frugiperda*, the impact on corn growth and the effect on the severity intensity. symptoms of attacks caused by *S. frugiperda* larvae in the field.

The fungal isolates used were from the collection of the Sriwijaya University Entomology Laboratory which was explored in 2020, consisting of 21 isolates, then the 10 best endophytic fungal isolates were selected with a total of 5 species, namely *Beauveria bassiana*, *Penicillium citrinum*, *Metarhizium anisopliae*, *Curvularia lunata*, *Chaetomium* sp. This research method is divided into two, Completely Randomized Design (CRD) with two applications, namely testing seven types of artificial feed, namely with the composition of corn (*Zea mays* L.) as a control, kale leaves (*Ipomoea reptans*), water kale leaves (*Ipomoea aquatica*). Forsk), annual spinach leaves (*Amaranthus hybridus* L.), mulberry leaves (*Morus rubra*), kolonjono grass leaves (*Brachiaria mutica*) and setaria grass leaves (*Setaria sphacelata*) which were repeated 5 times and the second application tested 10 isolates of endophytic entomopathogenic fungi with 3 repetitions in the laboratory. The second design was a Randomized Block Design (RAK) which was carried out in experimental fields and greenhouses using 3 isolates which were repeated 4 times.

The results of this study showed that the best artificial feed composition was obtained from spinach (*Amaranthus hybridus* L.) leaf treatment which was able to produce the highest weight of 6th instar larvae (212.58 mg) and the highest number of eggs found on pigweed plants (120.38 eggs per female). . Meanwhile, the effect of inoculation with endophytic entomopathogenic fungi had a negative impact on the growth and development of *S. frugiperda*. Starting from the larvae experiencing a decrease in appetite, experiencing mortality to the ability to lay eggs decreasing drastically. This is different from *S. frugiperda* which has a negative impact, the opposite is true for corn plants. Inoculation of endophytic entomopathogenic fungi has a positive effect on the growth rate of corn plants. The conclusion of this research is that fungal treatment on corn seedlings has a negative impact on the

growth and development of *S. frugiperda* but has a positive impact on corn plants and can stimulate the growth of corn plants.

Key words: Endophytic entomopathogenic fungi, fall armyworm, seed treatment and *Zea mays*

RINGKASAN

DELLANIA EKA RINDIANI, Aktivitas Jamur Entomopatogen Endofit pada *Spodoptera frugiperda* yang Dibiakan pada Pakan Buatan dan Potensi Jamur dalam Meningkatkan Pertumbuhan Jagung (Dibimbing oleh **SITI HERLINDA** dan **SUWANDI**)

Spodoptera frugiperda (FAW) (Lipidoptera: Noctuidae) merupakan hama baru dan menjadi hama utama pada tanaman jagung di Indonesia. Larva *S. frugiperda* hanya keluar di pagi hari untuk mencari makan dan selebihnya bersembunyi ke dalam gulungan daun muda jagung sehingga jamur entomopatogen yang bersifat endofit diperlukan untuk pengelolaan berkelanjutan yang efektif, efisien, dan ramah lingkungan. Selain itu, dalam skala laboratorium, perbanyakkan serangga uji menggunakan pakan buatan juga dilakukan. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian tujuh macam pakan butan asal tumbuhan liar terhadap pertumbuhan dan perkembangan *S. frugiperda*, untuk mengetahui pengaruh jagung yang diinokulasikan jamur endofit secara perlakuan benih terhadap pertumbuhan dan perkembangan *S. frugiperda*, dampak bagi pertumbuhan jagung serta pengaruh terhadap intensitas keparahan gejala serangan akibat larva *S. frugiperda* di lapangan.

Isolat jamur yang digunakan merupakan koleksi Laboratorium Entomologi Universitas Sriwijaya yang di eksplorasi pada tahun 2020 yang terdiri dari 21 isolat kemudian dipilih 10 isolat jamur endofit terbaik dengan total terdapat 5 spesies yaitu *Beauveria bassiana*, *Penicillium citrinum*, *Metarhizium anisopliae*, *Curvularia lunata*, *Chaetomium* sp. Metode penelitian ini terbagi menjadi dua, Rancangan Acak Lengkap (RAL) dengan dua aplikasi, yaitu pengujian tujuh macam pakan buatan, yaitu dengan komposisi jagung (*Zea mays* L.) sebagai kontrol, daun kangkung (*Ipomoea reptans*), daun kangkung air (*Ipomoea aquatica* Forsk), daun bayam tahun (*Amaranthus hybridus* L.), daun murbei (*Morus rubra*), daun rumput kolonjono (*Brachiaria mutica*) dan daun rumput setaria (*Setaria sphacelata*) yang diulang sebanyak 5 kali dan aplikasi kedua mengujikan 10 isolat jamur entomopatogen endofit dengan 3 ulangan di laboratorium. Rancangan kedua yaitu Rancangan Acak Kelompok (RAK) yang dilakukan di lahan percobaan dan rumah kaca menggunakan 3 isolat yang diulang sebanyak 4 kali.

Hasil pada penelitian ini diperoleh bahwa komposisi pakan buatan terbaik diperoleh perlakuan daun bayam (*Amaranthus hybridus* L.) yang mampu menghasilkan berat larva instar 6 tertinggi (212,58 mg) dan jumlah telur terbanyak terdapat pada tanaman pigweed (120,38 butir per betina). Sedangkan pengaruh inokulasi jamur entomopatogen endofit berdampak buruk bagi pertumbuhan dan perkembangan *S. frugiperda*. Dimulai dari larva yang mengalami penurunan nafsu makan, mengalami mortalitas sampai dengan kemampuan meletakkan telur yang menurun drastis. Lain halnya dengan dengan *S. frugiperda* yang memiliki dampak negatif justru sebaliknya terjadi pada tanaman jagung. Inokulasi jamur entomopatogen endofit berpengaruh positif pada laju pertumbuhan tanaman jagung. Kesimpulan pada penelitian ini perlakuan jamur pada bibit jagung memiliki dampak yang negatif bagi pertumbuhan dan perkembangan *S. frugiperda* namun

memiliki dampak positif bagi tanaman jagung dan dapat memacu pertumbuhan tanaman jagung.

Kata kunci: Jamur entomopatogen endofit, fall armyworm, perlakuan benih dan *Zea mays*

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Sebagai Salah Satu Syarat untuk Mendapatkan Gelar Magister Sains (M.Si)
Universitas Sriwijaya



Dellania Eka Rindiani
05012682226003

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LEMBAR PENGESAHAN

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TESIS

Sebagai Salah Satu Syarat untuk Mendapatkan Gelar Magister Sains (M.Si)
Fakultas Pertanian Universitas Sriwijaya

Oleh :


Dellania Eka Rindiani
05012682226003

Indralaya, April 2024


Pembimbing I


Prof. Dr. Ir. Siti Herlinda, M.Si.
NIP. 196510201992032001

Pembimbing II


Prof. Dr. Ir. Suwandi, M.Agr
NIP. 196801111993021001

Mengetahui,
Dekan Fakultas
Fakultas Pertanian Unsri


Prof. Dr. Ir. A. Muslim, M. Agr
NIP. 196412291990011001

Tesis dengan Judul “Aktivitas Jamur Endofit Entomopatogen pada *Spodoptera frugiperda* yang Dibiakan pada Pakan Buatan dan Potensi Jamur dalam Meningkatkan Pertumbuhan Jagung” oleh Dellania Eka Rindiani telah dipertahankan di hadapan Komisi Penguji Tesis Program Studi Ilmu Tanaman Pasca Sarjana Fakultas Pertanian Universitas Sriwijaya pada 16 April 2024 dan telah diperbaiki sesuai saran dan masukan tim penguji.

Komisi Penguji

1. Prof. Dr. Ir. Siti Herlinda, M.Si.
NIP. 196510201992032001

Ketua



2. Dr. Ir. Suwandi, M.Agr
NIP. 1671091710820007

Sekretaris



3. Prof. Dr. Elfita, M. Si
NIP. 196903261994122001

Anggota




4. Dr. Ir. Harman Hamidson, M.P
NIP. 196207101988111001

Anggota



Mengetahui,
Koordinator Program Studi
Ilmu Tanaman


Prof. Dr. Ir. Suwandi, M.Agr
NIP. 196801111993021001

PERNYATAAN INTEGRITAS

Yang bertanda tangan di bawah ini:

Nama : Dellania Eka Rindiani

NIM : 05012682226003

Judul : Aktivitas Jamur Entomopatogen Endofit pada *Spodoptera frugiperda* yang Dibiakan pada Pakan Buatan dan Potensi Jamur dalam Meningkatkan Pertumbuhan Jagung

Menyatakan bahwa semua data dan informasi yang dimuat di dalam tesis ini merupakan hasil penelitian saya sendiri di bawah supervisi pembimbing, kecuali yang disebutkan dengan jelas sumbernya. Apabila dikemudian hari ditemukan adanya unsur plagiasi dalam skripsi ini, maka saya bersedia menerima sanksi akademik dari Universitas Sriwijaya.

Demikian pernyataan ini saya buat dalam keadaan sadar dan tidak mendapat paksaan dari pihak manapun.



Indralaya, 16 April 2024

Yang membuat pernyataan



Dellania Eka Rindiani

RIWAYAT HIDUP

Penulis dilahirkan pada tanggal 19 Januari 2000 di Desa Teluk Dalem, Kabupaten Lampung Timur. Penulis merupakan anak pertama dari dua bersaudara dari pasangan Bapak Dedi Nasrial dan Ibu Ennylawati.

Penulis memulai pendidikan di TK ABA pada tahun 2005 dan dilanjutkan ke Sekolah Dasar Negeri 1 Teluk Dalem. Setelah itu melanjutkan Sekolah Menengah Pertama Negeri 1 Mataram Baru dan Sekolah Menengah Atas Negeri 1 Way Jepara. Setelah menyelesaikan pendidikan SMA tahun 2018 penulis melanjutkan pendidikan di Perguruan Tinggi Negeri Universitas Sriwijaya, Fakultas Pertanian, Jurusan Hama dan Penyakit Tumbuhan Pogram Studi Proteksi Tanaman melalui jalur SNMPTN. Penulis bekuliah dengan mendapatkan beasiswa Bidikmisi dan Beasiswa Relawan Wakaf Dhuafa Mulia.

Selama menjadi mahasiswi di Universitas Sriwijaya, penulis aktif mengikuti beberapa organisasi dan mendapat amanah seperti sekretaris Biro Danus BWPI FP 2018, sekretaris dinas Kominfo BEM KM FP tahun 2019, sekretaris departemen Medinfo HIMAPRO 2019, dan anggota Ristek BO Kurma 2021. Selain aktif di organisasi internal penulis juga mengikuti kegiatan eksternal seperti Relawan Wakaf Dhuafa Mulia dan volunteer. Penulis memiliki prestasi ditingkat nasional maupun internasional dan beberapa kali mendapatkan juara dibidang lomba karya tulis ilmiah dan desain poster. Pada tahun 2021 Penulis meraih gelar sebagai Mahasiswa Berprestasi Utama Fakultas Pertanian, Universitas Sriwijaya. Selain itu, penulis juga aktif menjadi asisten praktikum pada matakuliah Dasar-dasar Pelindungan Tanaman dan Entomologi.

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Penulis mengucapkan terima kasih kepada Prof. Dr. Ir. Siti Herlinda. M.Si dan Prof. Dr. Ir. Suwandi, M.Agr selaku pembimbing atas kesabaran dan perhatiannya mulai dari awal perencanaan, pelaksanaan hingga penelitian sampai akhir penyusunan dan penulisannya dalam tesis ini. Penelitian ini terdiri dari enam manuskrip, manuskrip pertama dan kedua didanai oleh anggaran DIPA Badan Layanan Umum Universitas Sriwijaya tahun Anggaran 2023 No. SP DIPA A-023.17.2.677515/2023 tanggal 10 Mei 2023 sesuai dengan SK Rektor No 0334/UN9.3.1/SK/2023 tanggal 3 Juli 2023, manuskrip ketiga didanai oleh Daftar Isian Pelaksanaan Anggaran (DIPA) Universitas Sriwijaya Tahun Anggaran 2024, manuskrip keempat, kelima dan keenam didanai oleh Daftar Isian Pelaksanaan Anggaran (DIPA) Lembaga Pengelola Dana Pendidikan Tahun Anggaran 2022 sesuai dengan PRJ-2/LPDP/2022 tentang Program Pendanaan Beasiswa Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi.

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Penulis

BAB 1 PENDAHULUAN

1.1. Latar Belakang

Spodoptera frugiperda (J.E. Smith) berasal dari ordo Lepidoptera yang keberadaannya menjadi serangga hama. Hama ini bersifat polifagus dan menyukai tanaman inang yang berkaitan dengan rerumputan seperti jagung, gandum dan oat (Maharani *et al.*, 2019). Hama ini menyerang tanaman jagung serta dapat menurunkan hasilnya dan berasal dari negara Amerika dan terus menyebar ke negara lainnya (De Groote *et al.*, 2020). Tercatat bahwa di negara Zimbabwe mampu menyerang 13,7-33,3 larva/30 tanaman dengan tingkat kerusakan antara 25 – 50% (Chimweta *et al.*, 2020). Negara Kenya tercatat kehilangan produksi hasil jagung mencapai 1 juta ton dan kerugian di seluruh dunia mencapai 37% (De Groote *et al.*, 2020). Pada awal tahun 2019, *S. frugiperda* ditemukan menyerang jagung di Sumatera (Maharani *et al.*, 2019) dan pada 26 Maret 2019 dilaporkan menyerang jagung di daerah Sumatera Barat (Sartiami *et al.*, 2020). Total keparahan serangan akibat hama ini di Indonesia mencapai 26,50 – 100% (P. Lestari *et al.*, 2020b). Pada skala penelitian di laboratorium diperlukan adanya pembiakan massal serangga uji. pembiakan massal serangga uji harus bersifat efektif, efisien dan murah. Perlu dirumuskan dan ditemukan pakan buatan yang cocok untuk *S. frugiperda* dalam meneliti biologi, perilaku, fisiologi, toksikologi, dan pemeliharaan massal *S. frugiperda*. Oleh karena itu, perlu adanya inovasi dan pengembangan pembuatan pakan buatan atau *artificial diet* (R. da S. Ramos *et al.*, 2022).

Pengendalian hayati yang dapat dilakukan adalah menggunakan jamur entomopatogen (Akutse *et al.*, 2019). Pengendalian ini menggunakan jamur entomopatogen seperti *Beauveria bassiana*, *Metarhizium anisopliae*, *Aspergillus* sp. sudah diterapkan di beberapa negara seperti Indonesia (Apriliani *et al.*, 2019; Herlinda, Gustianingtyas, *et al.*, 2021; Miranda-Fuentes *et al.*, 2020; Winarto & Nazir, 2012). Pengendalian ini bersifat ramah lingkungan, tidak menimbulkan dampak negatif dan tidak menyebabkan resistensi (Bamisile *et al.*, 2019). Jamur entomopatogen menghasilkan filtrat bersifat toksik yang berpotensi menjadi bahan

aktif *mycoinsecticides* yang dapat membunuh serangga hama (Gustianingtyas *et al.*, 2020). Hasil penelitian Sari *et al.*, (2022), melaporkan bahwa spesies jamur entomopatogen *B. bassiana* mampu menyebabkan kematian pada larva mencapai 51,33 %.

Pada penelitian Wu *et al.*, (2016), jamur endofit entomopatogen lebih efektif dalam mengendalikan engplikasian jamur endofit entomopatogen larva *S. frugiperda* dikarenakan larva menyerang dan masuk ke dalam titik tumbuh. Sehingga sulit dijangkau apabila digunakan pengendalian yang bersifat topikal yang harus mengenai tubuh serangga langsung (Hardiyanti *et al.*, 2018). Sedangkan apabila jamur bersifat endofit jamur tersebut berada di dalam jaringan tanaman (Kuzhuppillymyal-Prabhakarankutty *et al.*, 2020). Jamur endofit mampu mengkolonisasi jaringan tanaman dalam jangka waktu yang lama, menurut Biswas *et al.* (2012), keberadaan jamur *B. bassiana* yang mengkolonisasi tanaman *Corchorus olerius* dapat bertahan selama tiga bulan dan bahkan pada tanaman pinus mampu bertahan selama sembilan bulan (Brownbridge *et al.*, 2012). Hal ini menjadi keunggulan bahwa keberadaan jamur endofit pada fase vegetatif sampai generatif berdampak positif bagi tanaman. Namun, mengenai keberadaannya pada jaringan tanaman jagung perlu diteliti lebih lanjut. Oleh karena itu, penelitian ini diperlukan untuk mengetahui dampak jamur endofit yang diinokulasikan melalui perlakuan benih terhadap perkembangan dan pertumbuhan *S. frugiperda* serta untuk mengetahui dampak bagi tanaman jagung.

1.2. Rumusan Masalah

Berdasarkan latar belakang diatas, rumusan masalah dari penelitian ini adalah untuk mengetahui pengaruh tujuh macam pakan buatan/*artificial diet* terhadap pertumbuhan dan perkembangan serangga uji *S. frugiperda* di laboratorium dan untuk mengetahui pengaruh jamur entomopatogen endofit terhadap pertumbuhan, perkembangan *S. frugiperda* dan respon tanaman jagung.

1.3. Tujuan Penelitian

Berdasarkan rumusan masalah di atas, maka tujuan dari penelitian ini adalah untuk mengetahui pengaruh tujuh macam pakan buatan/*artificial diet* terhadap

pertumbuhan dan perkembangan serangga uji *S. frugiperda* di laboratorium dan untuk mengetahui pengaruh jamur entomopatogen endofit terhadap pertumbuhan, perkembangan *S. frugiperda* dan respon tanaman jagung.

1.4. Hipotesis Penelitian

Adapun hipotesis dari penelitian ini adalah diduga pemberian *artificial diet* mampu mempengaruhi pertumbuhan dan perkembangan serangga uji *S. frugiperda*. Diduga isolat jamur entomopatogen endofit dapat menyebabkan mortalitas terhadap larva *S. frugiperda* dan dapat mempengaruhi pertumbuhan dan perkembangan *S. frugiperda* serta dapat meningkatkan laju pertumbuhan tanaman jagung.

1.5. Manfaat Penelitian

Penelitian ini diharapkan dapat menambah ilmu pengetahuan mengenai teknologi pembuatan pakan buatan bagi pembiakan masal serangga uji *S. frugiperda*. Selain itu, dapat menambah ilmu pengetahuan mengenai teknologi pengendalian hayati menggunakan jamur entomopatogen endofit yang dapat melarutkan fosfat di lapangan.

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