

RINGKASAN

Penyakit antraknosa merupakan salah satu penyakit utama tanaman cabai yang disebabkan oleh jamur *Colletotrichum* sp., yang menyebabkan penurunan produksi hingga mencapai 45-60%. Salah satu alternatif pengendalian yang dapat diterapkan, yaitu pengendalian hayati dengan pengaplikasian agens hayati *Bacillus* sp. *Bacillus* sp. merupakan salah satu mikroba yang banyak dijumpai serta dapat diisolasi pada daerah rizosfer perakaran tanaman, termasuk putri malu. Tumbuhan putri malu banyak bersimbiosis dengan mikroba rizosfer, antara lain berasal dari genus *Rhizobium*, *Bacillus*, *Pseudomonas*, dan beberapa jenis *Actinomycetes*. Penelitian ini bertujuan untuk mengisolasi dan mengkarakterisasi *Bacillus* sp. asal rizosfer tumbuhan putri malu dataran rendah, mengetahui kemampuannya dalam menekan pertumbuhan beberapa mikroba patogen secara *in vitro*, mengetahui potensi *Bacillus* sp. sebagai pemacu pertumbuhan tanaman, dan menentukan isolat terbaik yang mampu menekan penyakit antraknosa pada buah cabai secara *in vivo*.

Penelitian ini dilaksanakan dari Juni 2024 hingga Juni 2025 di Laboratorium Perlindungan Tanaman, Universitas Jenderal Soedirman. Penelitian ini diawali dari pengambilan sampel rizosfer tumbuhan putri malu dari 3 lokasi dataran rendah, yaitu Kecamatan Purwokerto Utara Desa Karangwangkal, Kecamatan Kembaran Desa Karangsoeka, dan Kecamatan Binangun Desa Krikil. Sampel tersebut dibawa ke laboratorium untuk diisolasi dan dikarakterisasi secara makroskopis meliputi bentuk koloni, warna koloni, ukuran, elevasi, dan tepian. Pengujian kemampuan *Bacillus* sp. dilakukan terhadap *Colletotrichum* sp., *Fusarium* sp., *Rhizoctonia* sp., *Xanthomonas oryzae*, dan *Ralstonia solanacearum* secara *in vitro* menggunakan RAL (Rancangan Acak Lengkap) dengan 15 perlakuan sebanyak 2 ulangan. Variabel yang diamati, daya hambat pertumbuhan patogen dan ada tidaknya kerusakan miselium pada jamur patogen. Pengujian kemampuan *Bacillus* sp. sebagai pemacu pertumbuhan tanaman dilakukan dengan benih mentimun menggunakan RAK (Rancangan Acak Kelompok) dengan 15 perlakuan. Variabel yang diamati, kecepatan tumbuh benih, panjang akar, bobot segar akar, dan bobot segar kecambah. Pengujian kemampuan *Bacillus* sp. dalam mengendalikan penyakit antraknosa pada buah cabai rawit secara *in vivo* menggunakan RAK (Rancangan Acak Kelompok) dengan 4 perlakuan diantaranya kontrol air steril, fungisida, *Bacillus* RR 2.4, dan *Bacillus* RR 3.1. Variabel yang diamati meliputi, masa inkubasi, luas serangan, penghambatan luas serangan, dan indeks sampah. Data penelitian hasil isolasi dan karakterisasi dianalisis secara deskriptif dan data pengujian kemampuan *Bacillus* sp. dianalisis dengan ANOVA 5% dan dilakukan uji lanjut DMRT 5% apabila terdapat perbedaan nyata antar perlakuan.

Hasil penelitian menunjukkan bahwa terdapat 14 isolat bakteri *Bacillus* sp. yang berhasil diisolasi dari rizosfer tumbuhan putri malu asal dataran rendah, memiliki sel yang berbentuk batang (basil), bakteri gram positif, katalase dan oksidase positif, dan memiliki struktur endospora. Isolat terbaik dari hasil uji *in vitro*, yaitu isolat *Bacillus* RR 2.1 dan RR 3.4 yang memiliki kemampuan dalam menekan pertumbuhan jamur *Colletotrichum* sp., *Fusarium* sp., dan *Rhizoctonia* sp. lebih dari 50%. Isolat *Bacillus* RR 2.4 sebagai bakteri PGPR mampu meningkatkan

panjang akar sebesar 84,8% dibandingkan kontrol, sedangkan peningkatan bobot segar akar dan bobot segar kecambah secara berturut-turut diakibatkan oleh perlakuan isolat *Bacillus* RR 1.1 (52,9%) dan RR 3.2 (16,67%) dibandingkan kontrol. Aplikasi *Bacillus* isolat RR 2.1 menunjukkan isolat paling efektif dalam menunda masa inkubasi serta menekan penyakit antraknosa pada buah cabai rawit sebesar 69,35% dibanding kontrol. Hal ini menunjukkan bahwa *Bacillus* sp. memiliki potensi untuk dijadikan sebagai agensia pengendali hayati dalam menekan penyakit antraknosa cabai yang ramah lingkungan.



SUMMARY

Anthracnose was the primary disease affecting chili pepper, caused by the Colletotrichum sp. fungal pathogen which can reduce production by 45-60%. One alternative control method is biological control, which involves applying the biological agent Bacillus sp. Bacillus sp. is a microbe commonly found and can be isolated from the rhizosphere of plant roots, including the Mimosa pudica. The Mimosa pudica plant has many symbioses with rhizosphere microbial communities, including those from the genera Rhizobium, Bacillus, Pseudomonas, and various Actinomycetes. Therefore, this study aims to isolate and characterize Bacillus sp. from the rhizosphere of lowland in Mimosa pudica plants, investigate the ability to inhibit the growth of several microbial plant pathogens in vitro, found the potential microbes as a plant growth promoting rhizobacteria (PGPR), and identify the best isolate that potential against anthracnose disease in chili pepper in vivo.

This study was conducted from June 2024 to June 2025 at the Plant Protection Laboratory, Jenderal Soedirman University. This research began with sampling the rhizosphere of mimosa plants from 3 lowland locations, namely Karangwangkal Village, Karangsoka Village, and Krikil Village. The samples were taken to the laboratory to be isolated and characterized macroscopically, including colony shape, colony color, size, elevation, and edges. The bacteria that were successfully isolated were also characterized biochemically, including oxidase tests, Gram tests, catalase tests, and hypersensitivity tests in tobacco leaves. Bacteria were isolated and characterized macroscopically, microscopically, biochemical tests, and hypersensitivity tests. Testing the ability of Bacillus sp. against Colletotrichum sp., Fusarium sp., Rhizoctonia sp., Xanthomonas oryzae, and Ralstonia solanacearum in vitro using CRD (Completely Randomized Design) with fifteen treatments and repeated two times. The variables were observed including the inhibition of pathogens and the presence or absence of mycelium damage in pathogenic fungi. Testing the ability of Bacillus sp. as plant growth promoters with cucumber seeds using RBD (Randomized Block Design) with fifteen treatments. The variables were observed including seed growth rate, root length, fresh root weight, and fresh sprout weight. Testing the ability of Bacillus sp. to control anthracnose disease in chili pepper in vivo using RBD with four treatments, including sterile water control, fungicide, Bacillus RR 2.1, and Bacillus RR 3.4. The variables were observed including incubation period, area of attack, inhibition rate, and waste index. The research data from isolation and characterization were analyzed descriptively and research data from testing the ability of Bacillus using ANOVA ($\alpha=0.05$) and following by DMRT ($\alpha=0.05$) to determine significant differences.

Research results showed that 14 isolates of Bacillus sp. were successfully isolated from the rhizosphere of the mimosa pudica plant from the lowlands, had rod-shaped cells (bacilli), Gram-positive bacteria, positive catalase and oxidase, and had an endospore structure. The best isolates showed by Bacillus RR 2.1 and RR 3.4 isolates in the in vitro test, which could suppress the mycelium growth of Colletotrichum sp., Fusarium sp., and Rhizoctonia sp. fungal pathogens by more than 50%. Additionally, Bacillus RR 2.4 isolates have shown the potential to be

plant growth promoting rhizobacteria (PGPR) by enhancing root length by 84.8% in the control, meanwhile the increase in fresh root weight and fresh sprout weight respectively was caused by the treatment of Bacillus isolates RR 1.1 (52.9%) and RR 3.2 (16.67%) compared to the control. Besides that, the application of Bacillus RR 2.1 has proven to be the most effective isolate in extending the incubation period and reducing the symptoms of anthracnose disease in chili pepper by 69.35%. The potential of Bacillus sp. was proven to be a biocontrol agent that environmentally friendly against chili pepper anthracnose disease.

