

**ISOLASI DAN KARAKTERISASI BAKTERI ENDOFIT AKAR
ANGGREK (*Vanda* sp.) SEBAGAI AGEN PEMACU PERTUMBUHAN
PISANG (*Musa* sp.) PADA CEKAMAN TOKSIN *FUSARIC ACID***

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INTISARI

Indonesia merupakan salah satu produsen pisang terbesar di dunia, namun produktivitasnya masih terkendala oleh penyakit layu fusarium yang disebabkan oleh *Fusarium oxysporum* (*Fo*). Kerusakan jaringan tanaman akibat infeksi *Fo* dimediasi oleh *fusaric acid* (FA), senyawa toksik yang berperan dalam menekan fungsi fisiologis tanaman. Pemanfaatan bakteri endofit sebagai agen hayati berpotensi menjadi strategi alternatif yang ramah lingkungan untuk meningkatkan ketahanan tanaman terhadap cekaman tersebut. Penelitian ini bertujuan untuk: (1) mengevaluasi keberhasilan isolasi bakteri endofit dari akar anggrek *Vanda* sp.; (2) mengkarakterisasi potensi bakteri endofit sebagai agen pemacu pertumbuhan tanaman dan ketahanan terhadap patogen; serta (3) menganalisis pengaruh inokulasi bakteri endofit potensial terhadap pertumbuhan dan ketahanan bibit pisang di bawah cekaman FA. Bakteri endofit diisolasi dari akar anggrek *Vanda* sp. dan dikarakterisasi berdasarkan kemampuan produksi *indole-3-acetic acid* (IAA), aktivitas kitinase, serta sifat antagonis terhadap *Fo*. Isolat terpilih diidentifikasi secara molekuler menggunakan gen 16S rRNA dan diaplikasikan pada bibit pisang Raja yang diberi perlakuan FA dengan konsentrasi bertingkat. Sebanyak 29 isolat bakteri endofit berhasil diperoleh, seluruhnya mampu menghasilkan IAA. Empat isolat terbaik, yaitu A(2), A(4), B(2), dan D(5), menunjukkan aktivitas kitinase dan sifat antagonis terhadap *Fo*. Di antara keempat isolat tersebut, isolat B(2) memiliki daya hambat tertinggi dan menunjukkan toleransi terhadap FA hingga konsentrasi 1 mM. Identifikasi molekuler menunjukkan bahwa isolat B(2) termasuk dalam genus *Bacillus*. Inokulasi bakteri endofit B(2) tidak memberikan pengaruh signifikan terhadap parameter pertumbuhan vegetatif awal bibit pisang, namun secara konsisten dan signifikan menurunkan disease index pada seluruh tingkat konsentrasi FA.

Kata Kunci: *Bacillus* sp., biokontrol, endofit, plant growth promoter, toleransi stres.

**ISOLATION AND CHARACTERIZATION OF ENDOPHYTIC
BACTERIA FROM ORCHIDS ROOT (*Vanda* sp.) AS PLANT
GROWTH PROMOTERS AGENT ON BANANA (*Musa* sp.) IN TOXIN
STRESS FUSARIC ACID**

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ABSTRACT

Indonesia is one of the world's largest banana-producing countries; however, its productivity remains severely constrained by Fusarium wilt caused by *Fusarium oxysporum* (*Fo*). Tissue damage resulting from *Fo* infection is mediated by fusaric acid (FA), a phytotoxic secondary metabolite that disrupts plant physiological processes. The application of endophytic bacteria as biological control agents represents a promising alternative strategy to enhance plant tolerance to this stress. This study aimed to (1) evaluate the successful isolation of endophytic bacteria from the roots of *Vanda* sp. orchids; (2) characterize their potential as plant growth-promoting and pathogen-resistant agents; and (3) assess the effects of inoculation with selected endophytic bacteria on the growth performance and disease resistance of banana seedlings under FA-induced stress. Endophytic bacteria were isolated from *Vanda* sp. orchid roots and characterized based on indole-3-acetic acid (IAA) production, chitinase activity, and antagonistic activity against *Fo*. Selected isolates were molecularly identified using 16S rRNA gene sequencing and subsequently applied to Raja banana seedlings exposed to varying FA concentrations. A total of 29 endophytic bacterial isolates were obtained, all of which exhibited the ability to produce IAA. Among these, four isolates A (2), A (4), B (2), and D (5) demonstrated chitinase activity and antagonistic effects against *Fo*. Isolate B (2) showed the highest inhibitory activity and tolerance to FA up to 1 mM. Molecular identification confirmed that isolate B (2) belonged to the genus *Bacillus*. Inoculation with endophytic bacterium B (2) did not significantly influence early vegetative growth parameters of banana seedlings; however, it consistently and significantly reduced the disease index across all FA concentration levels.

Keywords: *Bacillus* sp., biocontrol, endophyte, plant growth promoter, stress tolerance.