

Karakterisasi dan aplikasi bakteri agen biokontrol: *Bacillus* sp. 140-B dan *Streptomyces* sp. L.3.1-DW terhadap Kapang Patogen *Fusarium oxysporum* Schlecht f. sp. *cubense* pada tanaman pisang (*Musa acuminata*) var. Cavendish = Characterization and applications of biocontrol bacteria agents: *Bacillus* sp. 140-B and *Streptomyces* sp. L.3.1-DW toward pathogenic fungi *Fusarium oxysporum* Schlecht f.sp. *cubense* on Banana Plant (*Musa acuminata*) var. Cavendish

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Abstrak

Bacillus sp. 140-B dan *Streptomyces* sp. L.3.1-DW diisolasi dari tanah dan rizosfer tanaman dari perkebunan nanas dan pisang di Provinsi Lampung. Kedua bakteri tersebut diuji kemampuannya dalam melawan patogen *Fusarium oxysporum* Schlecht f. sp. *cubense* (Foc) secara in-vitro dan in-vivo. Aplikasi *Bacillus* sp. 140-B dan *Streptomyces* sp. L.3.1-DW sebagai isolat tunggal maupun kombinasinya secara in-vivo pada tanaman pisang var. Cavendish dilakukan dalam rumah kaca selama 30 hari.

Tujuan dari penelitian ini adalah untuk mengkarakterisasi dan menguji potensi *Bacillus* sp. 140-B dan *Streptomyces* sp. L.3.1-DW sebagai agen biokontrol dalam menghambat patogen Foc dan mengkaji kemampuannya untuk menghasilkan enzim ketahanan tanaman pisang. Potensi *Bacillus* sp. 140-B dan *Streptomyces* sp. L.3.1-DW sebagai agen biokontrol ditunjukkan dengan kemampuannya dalam menghambat pertumbuhan patogen Foc, sintesis enzim protease dan kitinase ekstraseluler, produksi hormon tumbuh Indole-Acetic Acid (IAA), dan produksi enzim ketahanan tanaman phenylalanine ammonia-lyase (PAL) and tyrosine ammonia lyase (TAL). *Bacillus* sp. 140-B dan *Streptomyces* sp. L.3.1-DW juga berperan sebagai plant growth-promoting rhizobacteia (PGPR), yang diindikasikan dengan peningkatan pertumbuhan tanaman pisang, di mana perlakuan *Streptomyces* L.3.1-DW memiliki rata-rata tinggi tanaman tertinggi dibandingkan perlakuan lainnya, dengan atau tanpa infeksi Foc.

Hasil penelitian secara in-vitro dan in-vivo menunjukkan bahwa *Streptomyces* sp. L.3.1-DW memiliki kemampuan sebagai agen biokontrol yang lebih baik dibandingkan *Bacillus* sp. 140-B. Penelitian ini mengindikasikan bahwa *Bacillus* sp. 140-B dan *Streptomyces* sp. L.3.1-DW dapat digunakan sebagai alternatif untuk mengendalikan infeksi Foc.

.....*Bacillus* sp. 140-B and *Streptomyces* sp. L.3.1-DW were isolated from soil and rhizosphere area of pineapple and banana plantation in Lampung Province. Those bacteria were evaluated in-vitro and in-vivo tests against *Fusarium oxysporum* Schlecht f. sp. *cubense* (Foc). Application of *Bacillus* sp. 140-B and *Streptomyces* sp. L.3.1-DW as single isolate or in combination in banana plant var. Cavendish were tested under greenhouse conditions for 30 days.

The aims of this study were to characterize and investigate the potentials of *Bacillus* sp. 140-B and *Streptomyces* sp. L.3.1-DW as biocontrol agents to inhibit Foc pathogen and investigate their abilities to produce plant resistance enzymes. The potentials of *Bacillus* sp. 140-B and *Streptomyces* sp. L.3.1-DW as biocontrol agents were showed by their abilities to inhibit growth of Foc pathogen, synthesize extracellular protease and chitinase enzymes, produce growth hormone, such as Indole-Acetic Acid (IAA), and produce plant resistance enzymes, such as phenylalanine ammonia-lyase (PAL) and tyrosine ammonia lyase (TAL).

Bacillus sp. 140-B and *Streptomyces* sp. L.3.1-DW also act as plant growth-promoting rhizobacteia (PGPR), that indicated by improvement of banana growth, in which *Streptomyces* L.3.1-DW caused the highest growth of banana either with or without Foc infection.

In-vitro and in-vivo tests was showed that *Streptomyces* sp. L.3.1-DW had better biocontrol activities compared to *Bacillus* sp. 140-B. This study indicated that *Bacillus* sp. 140-B and *Streptomyces* sp. L.3.1-DW could be used as alternative solutions to control Foc pathogen.