

## INTISARI

### KERAGAMAN, BIOEKOLOGI *Rhizoctonia solani* AG1-IA DAN PENGENDALIAN HAYATI PENYAKIT HAWAR PELEPAH PADA JAGUNG DENGAN *Trichoderma asperellum*

*Rhizoctonia solani* merupakan salah satu patogen penting pada jagung penyebab penyakit hawar pelepah. Penyebaran penyakit hawar pelepah akhir-akhir ini meluas. Intensitas serangan penyakit yang tinggi akan mengakibatkan kehilangan hasil pada tanaman jagung hingga 100%. Pengetahuan tentang pengelompokan isolat *R. solani* berdasarkan morfologi, molekuler, karakteristik bioekologi sangat penting karena efektivitas penggunaan suatu mikrobial antagonis sebagai agens pengendali hayati untuk mengendalikan *R. solani* dengan berbagai anastomosis grup (AG) hanya dapat bersifat spesifik untuk kelompok anastomosis tertentu saja. Tujuan dari penelitian ini adalah mengidentifikasi dan mengkarakterisasi secara morfologi dan molekuler isolat *R. solani* yang dikoleksi dari 13 provinsi, mempelajari bioekologi (patogenisitas pada jagung, kisaran inang, pengaruh suhu, pH, dan cahaya), mengetahui potensi isolat *Trichoderma asperellum* dalam menghambat pertumbuhan *R. solani* secara *in vitro* dan mekanisme antagonisme kompetisi, mikoparasitisme, dan antibiosis terhadap *R. solani*, dan mengetahui efektivitas *T. asperellum* terhadap *R. solani* di rumah kaca. Penelitian dilakukan melalui empat tahap, yaitu: (1) Koleksi, isolasi, karakterisasi, keragaman morfologi, identifikasi dengan primer spesifik AG1-IA, dan keragaman genetik *R. solani* dengan penanda SSR (*Simple Sequence Repeat*), (2) Bioekologi *R. solani* dilakukan dengan lima pengujian: patogenisitas, kisaran inang, pengaruh suhu, pH dan cahaya, (3) Pengujian antagonisme isolat *T. asperellum* terhadap *R. solani* secara *in vitro*, mekanisme antagonisme kompetisi, mikoparasitisme, dan antibiosis terhadap *R. solani*, dan efektivitas isolat *T. asperellum* terhadap *R. solani* di rumah kaca. Hasil penelitian menunjukkan empat puluh tiga isolat *R. solani* (41 isolat jagung dan 2 isolat padi) penyebab hawar pelepah dari 13 provinsi di Indonesia mempunyai keragaman secara morfologi maupun molekuler. Keragaman morfologi dan kultur 43 isolat *R. solani* pada nilai koefisien 0,73 menggunakan analisis UPGMA terbagi menjadi empat kluster. Keragaman genetik 43 isolat *R. solani* dengan 10 primer SSR menggunakan *Neighbour-Joining* menghasilkan pohon filogenetik yang terpisah menjadi tiga kluster. Bioekologi isolat *R. solani* berupa patogenisitas, kisaran inang, pengaruh pH dan suhu medium, serta pengaruh cahaya menunjukkan adanya keragaman. Hasil uji patogenisitas 43 isolat *R. solani* menunjukkan lima kriteria ketahanan, yaitu tidak virulen (1 isolat), kurang virulen (7 isolat), moderat (2 isolat), virulen (19 isolat) dan sangat virulen (14 isolat). Delapan isolat *R. solani* asal jagung dan padi virulen yang diuji, 6 isolat jagung dapat menginfeksi padi, jali, kedelai dan tembakau. Satu isolat jagung (SBH) dan padi dapat menginfeksi padi, jali, dan kedelai, tetapi tidak dapat menginfeksi tembakau. Laju pertumbuhan optimum 24 isolat *R. solani* pada suhu 30 °C, kisaran pH 7-9, dan kondisi gelap 24 jam. Hasil pengujian secara *in vitro* menunjukkan 11 isolat *T. asperellum* memiliki potensi menghambat *R. solani* berkisar 59,06-88,30% melalui mekanisme berupa kompetisi, mikoparasitisme, dan antibiosis dengan mengeluarkan enzim ekstraseluler kitinase dan  $\beta$ -1,3-glukanase. *T. asperellum* isolat dengan LMBK dan AMB mempunyai potensi tertinggi untuk pengendalian *R. solani* berdasarkan nilai aktivitas enzimatik dan kemampuan antagonisme *in vitro*, akan tetapi pada pengujian di rumah kaca isolat LMBK mempunyai efektivitas dan efikasi menekan penyakit hawar pelepah lebih tinggi daripada isolat AMB.

**Kata kunci:** keragaman, bioekologi, *Rhizoctonia solani*, *Trichoderma asperellum*, jagung

## ABSTRACT

### **DIVERSITY, BIOECOLOGY OF *Rhizoctonia solani* AG1-IA AND BIOLOGICAL CONTROL OF BANDED LEAF AND SHEATH BLIGHT DISEASE ON MAIZE WITH *Trichoderma asperellum***

*Rhizoctonia solani* causing banded leaf and sheath blight is one of important pathogens on maize. Recently, the banded leaf and sheath blight disease distributed widely over the worldwide. The disease can devastate crops with yield losses up to 100%. Knowledge related to the classification of *R. solani* isolates based on morphological, molecular, and bioecological characteristics is necessary since the effectiveness of antagonistic microbes mostly used as biological control for anastomosis group (AG) of *R. solani* can be very specific to certain anastomosis group only. The objectives of this study were to identify and characterize the morphological and molecular characteristics of the isolates of *R. solani* collected from thirteen provinces, to observe their bioecological characteristics (pathogenicity on maize, host range, temperature, pH, and light effects), to reveal the potential of *Trichoderma asperellum* isolates in inhibiting the growth of *R. solani* in vitro and the mechanism of antagonistic competition, mycoparasitism, and antibiosis against *R. solani*, and to understand the effectiveness of *T. asperellum* in controlling *R. solani* in screen house. The research was conducted in four stages, i.e. (1) Collection, isolation, characterization, morphological variability, identification using specific primer AG1-IA, and genetic variability of *R. solani* using SSR (Simple Sequence Repeat) primer, (2) Bioecology of *R. solani* was analyzed using five tests including pathogenicity, host range, temperature effect, pH effect, and light effect, (3) In vitro testing of *T. asperellum* isolates antagonism on *R. solani*, the mechanism of antagonistic competition, mycoparasitism, and antibiosis against *R. solani*, and the effectiveness of *T. asperellum* isolates on *R. solani* in screen house. The results showed that 43 isolates of *R. solani* (41 isolates from maize and 2 isolates from rice) causing banded leaf and sheath blight morphological and molecular variability. Morphological variability of 43 *R. solani* isolates at coefficient value of 0.73 using UPGMA analysis was divided into 4 clusters. Genetic variability of 43 *R. solani* isolates with 10 SSR primers using Neighbour-Joining resulted in phylogenetic tree which was divided into 3 clusters. There was variability in the bio-ecology of *R. solani* isolates collected from inside and outside of Java comprising pathogenicity, host ranges, effects of medium pH and temperature, and effects of light. The pathogenicity test results of 43 *R. solani* isolates showed 5 resistance criteria, i.e. avirulent (1 isolate), less virulent (7 isolates), moderate (2 isolates), virulent (19 isolates) and highly virulent (14 isolates). Eight virulent isolates of *R. solani* from maize and rice were tested, six maize isolates able to infect rice, adlay millet, soybean, and tobacco. One maize isolate (SBH) and rice (NGW) can infect rice, adlay millet, and soybeans, but cannot infect tobacco. The optimum growth rate of the 24 *R. solani* isolates was at temperature of 30°C, pH 7-9, and dark condition within 24 hours. The results of in vitro testing showed that eleven isolates of *T. asperellum* had potential to inhibit *R. solani* up to 59.06-88.30%, had ability to produce extracellular enzyme of chitinase and  $\beta$ -1,3-glucanase. *T. asperellum* LMBK and AMB isolates had the highest potential for *R. solani* control based on the value of enzymatic activity and in vitro antagonism ability, but the experiment in screen house showed that LMBK isolate have a higher effectiveness and efficacy suppress banded leaf and sheath blight disease than AMB isolate.

**Keywords:** variability, bioecology, *Rhizoctonia solani*, *Trichoderma asperellum*, maize