

INTISARI

Penyebab penyakit layu pisang, *Fusarium oxysporum* f.sp. *cubense* Tropical race 4 (FocTR4), memiliki kemampuan menghasilkan gas berbau menyengat saat ditumbuhkan di beras. *Electronic nose* (*e-nose*) memiliki potensi untuk dikembangkan sebagai alat deteksi dini keberadaan FocTR4 di lahan perkebunan pisang. Pengembangan *e-nose* memerlukan data terkait profil senyawa volatil (VOC) FocTR4. Penelitian ini bertujuan untuk mengidentifikasi profil senyawa volatil FocTR4 dan ekspresi gen penyandi volatil terkait. Profil VOC isolat FocTR4 yang ditumbuhkan di media PDA, beras, tanah, tanah+beras, dan plantlet pisang Cavendish diidentifikasi dengan *GeNose-19* dan SPME-GCMS. Sampel tanah yang digunakan adalah tanah dari lahan endemik FocTR4 (tanah *hotspot*), tanah *non-hotspot* di lahan tanaman pisang bergejala FocTR4 dan tanaman sehat dari lahan perkebunan pisang PT.GGP Lampung. Ekspresi gen penyandi volatil terkait FocTR4 di media PDA dan beras juga diidentifikasi dengan metode qRT-PCR. Sensor *e-nose* sensitif pada VOC isolat FocTR4 di medium PDA dan beras serta mampu membedakan profil VOC tanah *hotspot* dan *non-hotspot*, tanah sehat dan sakit, yang diinduksi beras. Hari ke-9 inkubasi sampel adalah hari terbaik untuk deteksi dengan *e-nose* Alkohol adalah kelompok senyawa VOC dengan persentase terbesar FocTR4 media PDA (52,3%) dan beras (53,2%). Senyawa paling dominan FocTR4 di media PDA dan beras adalah *isopropyl alcohol* dengan persentase berturut-turut adalah 23,5% dan 47,4%. Penambahan *inducer* beras pada sampel tanah meningkatkan jumlah VOC dan respon sensor *e-nose* secara signifikan. Senyawa sesquiterpen FocTR4 hanya teridentifikasi di media PDA. Kandidat senyawa marker untuk deteksi FocTR4 di tanah yang diinduksi beras adalah *isopropyl alcohol* dan *isoamyl acetate* (berkorelasi positif), serta *1-butanol* dan *butyl butyrate* (berkorelasi negatif). Gen penyandi VOC FocTR4 yang mengalami peningkatan ekspresi baik di media PDA maupun beras adalah *alcohol dehydrogenase* dan *putative-acetate kinase*. Gen *farnesylpyrophosphate synthase* hanya terekspresi di media PDA. Dataset profil VOC FocTR4 sangat penting untuk pengembangan biosensor berbasis *e-nose*.

Kata kunci: FocTR4, *electronic-nose*, senyawa volatil, gen penyandi volatil.

Abstract

Fusarium oxysporum f.sp. *cubense* Tropical Race 4 (FocTR4) has the ability to produce gases with a strong odor when cultured in rice medium. *Electronic noses* probably have the potential to be developed as early detection tools for FocTR4 detection in banana plantations. Volatile organic compound profiles of FocTR4 were needed to develop *e-nose*. The aim of the research is to identify the VOC of FocTR4 using GeNose-19 and SPME-GC-MS and also measure the relative gene expression level of VOC-related genes. Two FocTR4 isolates from GGP Company and Bantul were inoculated in culture medium (PDA), rice, soil, soil + rice, and interacted with Cavendish plantlets. They were identified using GeNose-19 and SPME GC-MS. GGP isolates were used as a study model in relative gene expression tests with qRT-PCR methods. E-nose sensors were able to detect FocTR4 in PDA and rice with good sensitivity; furthermore, they were able to discriminate the VOC pattern between endemic soil and non-endemic soil induced by rice. The optimum sampel incubation for e-nose detection is Day 9 (H-9) with a minimum accuracy of more than 90%. Alcohols groups were be the major percentage of VOC FocTR4 growth in PDA and rice, for PDA was 52,3%, and rice 53,2%. The most FocTR4 VOC in PDA, rice, and soil+rice medium was isopropyl alcohol. Inducing soil with rice significantly increased the VOC numbers and sensor sensitivity. The marker candidate VOC compounds of FocTR4 were isopropyl alcohol and isoamyl acetate (positive correlation), followed by 1-butanol and butyl butyrate (negative correlation). The related genes with rising expression in both PDA and rice were *alcohol dehydrogenase* and *the putative acetate kinase* gene. On the other hand, *farnesylpyrophosphate synthase* has been increased only in PDA medium. Datasets of VOC profiles from FocTR4 is important to develop e-nose.

Keywords: FocTR4, *electronic nose*, volatile compounds, volatile biosynthetic gene