

INTISARI

Penelitian ini bertujuan untuk mengevaluasi potensi *frass Black Soldier Fly (Hermetia illucens)* dalam meningkatkan pertumbuhan dan aktivitas metabolit sekunder tanaman *Broad beans (Vicia faba* L.) serta ketahanannya terhadap serangan *Spodoptera litura* di bawah kondisi terkendali di Jepang. Penelitian dilakukan secara eksperimental dengan tiga perlakuan, yaitu *frass* BSF, pupuk NPK, dan kontrol (tanpa pupuk), masing-masing dengan 10 tanaman. Parameter pertumbuhan yang diamati meliputi tinggi tanaman, jumlah daun, dan lebar daun yang dianalisis menggunakan uji ANOVA dan *Duncan Multiple Range Test* (DMRT) pada perangkat lunak RStudio. Analisis respons biokimia tanaman dilakukan menggunakan *Gas Chromatography-Mass Spectrometry* (GC-MS) setelah aplikasi sekresi oral larva *Spodoptera litura* untuk menstimulasikan stres biotik.

Hasil penelitian menunjukkan bahwa BSF *frass* secara signifikan meningkatkan pertumbuhan vegetatif tanaman dan memicu emisi senyawa organik volatil (VOC) seperti 3-hexen-1-ol, nonanal, dan decanal dengan intensitas tertinggi. Senyawa-senyawa ini berperan penting dalam mekanisme *Induced Systemic Resistance* (ISR) melalui aktivasi sinyal pertahanan tanaman. Temuan ini menunjukkan bahwa BSF *frass* tidak hanya berfungsi sebagai pupuk organik, tetapi juga sebagai pemicu alami sistem imun tanaman. Oleh karena itu, BSF *frass* memiliki potensi besar sebagai input pertanian berkelanjutan dalam sistem pertanian organik.

Kata kunci: *Black Soldier Fly* (BSF), *frass*, *Broad beans (Vicia faba)*, *Gas Chromatography-Mass Spectrometry* (GC-MS), metabolit sekunder

ABSTRACT

This study aims to evaluate the potential of Black Soldier Fly (*Hermetia illucens*) frass in enhancing the growth performance and secondary metabolite activity of broad beans (*Vicia faba* L.) as well as their resistance against *Spodoptera litura* under controlled conditions in Japan. The experiment was conducted using three treatments: BSF frass, NPK fertilizer, and control (without fertilizer), each consisting of ten plants. Growth parameters, including plant height, leaf number, and leaf width, were analyzed using ANOVA and Duncan's Multiple Range Test (DMRT) with the RStudio software. Biochemical responses of plants were analyzed through Gas Chromatography–Mass Spectrometry (GC–MS) after the application of *Spodoptera litura* larval oral secretion to simulate biotic stress.

The results revealed that BSF frass significantly enhanced vegetative growth and induced the emission of volatile organic compounds (VOCs) such as 3-hexen-1-ol, nonanal, and decanal at the highest levels. These compounds play a crucial role in the mechanism of Induced Systemic Resistance (ISR) through the activation of plant defense signaling pathways. The findings indicate that BSF frass functions not only as an organic fertilizer but also as a natural elicitor of plant immune responses. Therefore, BSF frass shows great potential as a sustainable agricultural input in organic farming systems.

Keywords: Black Soldier Fly (BSF), frass, Broad beans (*Vicia faba*), Gas Chromatography–Mass Spectrometry (GC–MS), secondary metabolites