

DAFTAR PUSTAKA

- Aaron, T., A. M. R. Juan, and M. R. Guadalup. 2016. Insects as sustainable food ingredients: Production, processing, and food applications. Edition 1st. Academic Press. Elsevier Inc., Amsterdam.
- Adams, D.S., and E. A. Koutsos. 2024. Applied research note: Black Soldier Fly Larvae Frass is an effective feed ingredient for broiler diets. *Journal of Applied Poultry Research*, 33, 100493.
- Agatha, O., D. Mutwil-Anderwald, J. Y. Tan, & M. Mutwil. 2024. *Plant sesquiterpene lactones*.
- Ahmad, M., M. I. Arif, and Z. Ahmad. 2013. Resistance of *Spodoptera litura* (Lepidoptera: *Noctuidae*) to new chemistries in Pakistan. *Crop Protection*, 57: 49-55.
- Amin, S., T. Agustina, M. Agustin, dan S. P. Dewi. 2025. Kajian metabolit sekunder bajakah (*spatholobus littoralis hassk.*) dan peran kimia medisinal dalam pengembangan obat herbal antikanker payudara serta antioksidan. *Journal of Innovative and Creativity*, 5(2): 27-34.
- Anggraito, Y. U., R. Susanti, R. S. Iswari, A. Yuniastuti, Lisdiana, W. H. Nugrahaningsih, N. A. Habibah, dan S. H. Bintari. 2018. Metabolit sekunder dari tanaman: Aplikasi dan Produksi. Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Semarang, Semarang.
- Beesigamukama, D. 2020. Exploring Black Soldier Fly frass as novel fertilizer for improved growth, yield and disease resistance in maize. *Frontiers in Plant Science*, 11, 1447.
- Beesigamukama, D., S. Subramanian, and C. M. Tanga. 2022. Nutrient quality and maturity status of frass fertilizer from nine edible insects. *Scientific Reports*, 12.
- Ben-Abu, Y., and M. Itsko. 2021. Changes in "natural antibiotic" metabolite composition during tetraploid wheat domestication. *Scientific Reports* (11): 20340.
- Beasley, J., J. Kuehny, T. Gentimis, and J. Fields. 2023. Black Soldier Fly Frass Supports Plant Growth and Reduces Nitrogen Leaching during Coleus Production. *HortTechnology*, 33(3), 305-312.
- Brasier, K., I. Zaragoza, J. Knecht, R. Munster, H. Coulter, A. Potter, E. Enke, A. Fox, E. Mosqueda, and H. Zakeri. 2022. Potential of Faba Bean (*Vicia faba* L.) for Dual purpose Vegetable Production and Cover Cropping. *Hort Science*, 58(1): 23-31.
- Candraningtyas, C. F., and M. Indrawan. 2023. Analisis efektivitas penggunaan *Plant Growth Promoting Rhizobacteria* (PGPR) untuk peningkatan pertanian berkelanjutan. *Risalah Kebijakan Pertanian dan Lingkungan*, 10(2), 88–99.
- Chavez, M. Y., A. Villa Ignacio, J. K. Craver, and J. Boussetot. 2025. Investigating Black Soldier Fly Larval (*Hermetia illucens*) Frass Applications as a Partial Peat Replacement and Liquid Fertilizer in Brassicaceae Crop Production. *Agrochemicals*, 4(2): 8.
- Chia, S. Y., J. W. Lim, and Y. T. Lim. 2017. Black soldier fly larvae as a source of high-

- quality protein for livestock feed. *Frontiers in Veterinary Science*, 4, 101.
- Chia, S. Y., J. J. A. van Loon, and M. Dicke. 2023. Effects of frass from larvae of black soldier fly (*Hermetia illucens*) and yellow mealworm (*Tenebrio molitor*) on growth and insect resistance in field mustard (*Brassica rapa*): differences between insect species and frass treatments. *Entomologia Experimentalis et Applicata*.
- Chiam, Z., J. T. E. Lee, J. K. N. Tan, S. Song, S. Arora, Y. W. Tong, and H. T. W. Tan. 2021. Evaluating the potential of okara-derived black soldier fly larval frass as a soil amendment. *Journal of Environmental Management*, 286.
- Crepon, K., P. Marget, C. Peyronnet, B. Carrouee, P. Arese, and G Duc. 2010. Nutritional value of faba bean (*Vicia faba L.*) seeds for feed and food. *Field Crops Research*, 115(3): 329-339.
- Dalimunthe, C. I., and A. Rachmawan. 2017. Prospek pemanfaatan metabolit sekunder tumbuhan sebagai pestisida nabati untuk pengendalian patogen pada tanaman karet. *Warta Perkaretan*, 36(1), 15-28.
- Diener, S., C. Zurbrügg, and K. Tockner. 2011. Conversion of organic material by black soldier fly larvae: Establishing optimal feeding rates. *Waste Management*, 31(5), 1077-1083.
- Divekar P. A., S. Narayana, B. A. Divekar, R. Kumar, B. G. Gadratagi, A. Ray, A. K. Singh, V. Rani, V. Singh, A. K. Singh, A. Kumar, R. P. Singh, R. S. Meena, and T. K. Behera. 2022. Plant Secondary Metabolites as Defense Tools against Herbivores for Sustainable Crop Protection. *Int J Mol Sci*, 23(5):2690.
- Divekar, P. A., A. Mishra, and A. K. Singh. 2023. Plant secondary metabolites for defense against herbivores. In *Plant Specialized Metabolites*. Springer.
- Duranti, M. 2006. Legume seeds: Protein content and nutritional value. *Field Crops Research*, 102(2): 107-116.
- Dzepe, D., T. K. Mbenda, G. Ngassa, H. Mube, S. Y. Chia, Y. Aoudou, and R. Djouaka. 2022. Application of Black Soldier Fly Frass, *Hermetia illucens* (Diptera: *Stratiomidae*) as Sustainable Organic Fertilizer for Lettuce, *Lactuca sativa* Production. *Open Journal of Applied Sciences*, 12:1632-1648.
- Fuhrmann A, B. Wilde, R. F. Conz, S. Kantengwa, M. Konlambigue, B. Masengesho, K. Kintche, K. Kassa, W. Musazura, L. Späth, M. Gold, A. Mathys A, J. Six, and M. Hartmann. 2022. Residues from black soldier fly (*Hermetia illucens*) larvae rearing influence the plant-associated soil microbiome in the short term. *Microbiol.*
- Garttling, D., and H. Schulz. 2021. Compilation of Black Soldier Fly Frass Analyses. *Journal of Soil Science and Plant Nutrition*, 21.
- Gebremikael, M. T., N. V. Wickeren, P. S. Hosseini, and S. D. Neve. 2022. The impact of Black Soldier Fly frass on nitrogen availability, microbial activities, C Sequestration, and Plant Growth. *Frontiers in Sustainable Food Systems* (6): 1-13.
- Gulo, N. O., S. W. A. Lase, D. S. T. Laoli, M. Gulo, and N. K. Lase. 2024. Pemanfaatan lahan dengan sistem pengolahan yang baik dan penggunaan pupuk organik untuk menerapkan sistem pertanian berkelanjutan. *Penarik: Jurnal Ilmu Pertanian dan Perikanan*, 1(2).
- Hadi, P. H., T. Rahayu, H. Zakaria, S. Suharno, S. Nurlela, and S. Sarsono. 2021.

- Pemberdayaan Masyarakat Kelurahan Kadipiro Dan Nusukan Kota Surakarta Dalam Penanganan Sampah Organik Melalui Budidaya Maggot (*Hermetia illucens*). E-Amal: Jurnal Pengabdian Kepada Masyarakat, 1(2): 81–92.
- Haryuni, F. S. Bagu, E. H. U. Susila, Salawati, S. O. G. Afner, S. R. O. S. Chan, Yetriwati, S. H. Wahyuni, T. Wulanitka, dan N. A. Rosadi. 2024. Sistem pertanian organik. CV HEI Publishing Indonesia, Padang.
- Matsui, K., and J. Engelberth. Green Leaf Volatile-The Forefront of Plant Responses Against Biotic Attack. *Plant and Cell Physiology*, 63(10): 1378-1390.
- Menino, R. A. 2021. Black Soldier Fly Frass as a fertilizer: Current status and future perspectives. *Waste management*, 119: 183-194.
- Kanani, H., and M. I. Klapa. 2007. Data correction strategy for metabolomics analysis using GC-MS. *Metabolic Engineering*, 9(1): 39-51.
- Kenchanna, D., T. M. Waliczek, and M. L. Drewery. 2024. Evaluating Black Soldier Fly (*Hermetia illucens*) Frass and Larval Sheddings in the Production of a Quality Compost. *Fermentation* 2024, 10: 613.
- Khan, A., F. Kanwal, S. Ullah, M. Fahad, L. Tariq, M. T. Altaf, A. Riaz, and G. Zhang. 2025. Plant secondary metabolites: Central regulators against abiotic and biotic stresses. *Metabolites*, 15(4): 276.
- Menino, R. A. 2021. Black Soldier Fly Frass as a fertilizer: Current status and future perspectives. *Waste management*, 119: 183-194.
- Mirwan, M., dan A. M. Rizki. 2025. Analisis Kandungan Unsur Hara Biokonversi Sampah Organik Menggunakan Larva BSF untuk Mendukung Peningkatan Kesuburan Tanah. *Jukung: Jurnal Teknik Lingkungan*, 11(1): 69–80.
- Mubarok, W. Z., Y. R. Ahadiyat, dan Tamad. 2021. Pemupukan N-P-K dan Pupuk Organik Cair terhadap Pertumbuhan, Fisiologi dan Hasil Tanaman Jawawut (*Setaria italica* L.). *Jurnal Penelitian Pertanian Terapan*, 23(1): 55–63.
- Mutyambai, D. M., J. M. Mutua, A. A. Jalloh, D. Beesigamukama, A. Kessier, S. Subramanian, T. Dubois, S. Ekesi, and C. M. Tanga. 2025. Insect frass fertilizer upregulates maize defence genes and resistance against an invasive herbivore pest. *Scientific Reports* (15): 1-15.
- Rahayu, S., A. T. P. Irianti, dan S. Oktarianti. 2022. Efektivitas Pemupukan NPK dan Supernasa pada Budidaya Tanaman Bawang Merah (*Allium ascalonicum* L.). *Jurnal Teknotan*, 16(2): 75.
- Reswita, Z. A. Noli, and R. Rahayu. 2022. Effect of giving frass *Hermetia Illucen* L. on soil physical chemical properties, chlorophyll content and yield of upland rice (*Oryza sativa* L.) on ultisol soil. *Eduvest- Journal of Universal Studies*, 2(2): 336-346.
- Rismayani, D., A. T. Aulia, Nopiyanti, R. Rahayu, and M. Idris. 2024. Biology of Black Soldier Fly (*Hermetia illucens*) and Utilization of its Waste (Maggot Frass) for Plant Growth: A Literature Review. *Jurnal Biologi Tropis*, Universitas Andalas.
- Romera, F. J., M. J. Garcia, C. Lucena, A. M. Medina, M. A. Aparicio, J. Ramos, E. Alcantara, M. Angulo, and R. P. Vicente. 2019. Induced Systemic Resistance (ISR) and Fe Deficiency Responses in Dicot Plants. *Frontiers in Plant Science*, 10(287): 1-17.

- Salomon, M. J., T. R. Cavagnaro, and R. A. Burton. 2025. Potential of black soldier fly larvae frass (BSFL) as a novel fertilizer: impacts on tomato growth, nutrient uptake, and mycorrhizal formation. *Plant and Soil*.
- Sheppard, D. C., L. Newton, and S. A. Thompson. 2002. A value-added method for utilizing food waste: Black soldier fly larvae. In: *Proceedings of the 4th International Symposium on Insect–Plant Relationships*. Springer, Dordrecht.
- Siddiqui, S. A., A. S. Gadge, M. Hasan, T. Rahayu, S. N. Povetkin, I. Fernando, and R. Castro-Muñoz. 2024. Future opportunities for products derived from black soldier fly (BSF) treatment as animal feed and fertilizer – A systematic review. *Environment, Development and Sustainability*, 26: 30273–30354.
- Susilo, H., N. Nurmayulis, M. A. Syahbana, and A. H. Sodik. 2024. The Potential of Frass BSF as an Organic Fertilizer for Making Sustainable Agriculture a Reality. *Jurnal Biologi Tropis*, 24 (2): 209 – 217.
- Tanaka, J., T. Hayashi, and H. Iwata. 2016. A practical, rapid generation-advancement system for rice breeding using simplified biotron breeding system. *Breeding science*, 66: 542-551.
- Tanga, C. M., D. Beesigamukama, M. Kassie, P. J. Egonyu, C. J. Ghemoh, K. Nkoba, S. Subramanian, A. O. Anyega, and S. Ekesi. 2022. Performance of black soldier fly frass fertilizer on maize (*Zea mays L.*) growth, yield, nutritional quality, and economic returns. *Journal of Insects as Food and Feed*, 8(2): 185-196.
- Tomberlin, J. K., D. C. Sheppard, and J. A. Joyce. 2009. Black soldier fly larvae as a feedstuff for poultry. *Journal of Insect Science*, 9(1), 1-6.
- War, A. R., M. G. Paulraj, M. Y. War, and S. Ignacimuthu. 2012. Role of plant secondary metabolites in insect-plant interactions: a review. *Arthropod-Plant Interactions*, 6(3): 247-258.
- Watson C., C. Schollosser, J. Vogerl, and F. Wichern. 2021. Excellent excrement? Frass impacts on a soil’s microbial community, processes and metal bioavailability. *Applied Soil Ecology*, 168.
- Wibowo, A., dan E. N. Afifah. 2021. Pendekatan metabolomik untuk mendeteksi ketahanan tanaman kopi terhadap nematoda parasit. *Warta Pusat Penelitian Kopi dan Kakao Indonesia*, 33(2): 1–6.
- Xiang, L., Z. Xiu-ge, X. Chun, G. Yu-lin, and D. Wen-xia. 2020. Behavioral responses of potato tuber moth (*Phthorimaea operculella*) to tobacco plant volatiles. *Journal of Integrative Agriculture*, 19(2): 325-332.
- Xu, S., M. Yuan, S. J. Chapman, N. Zheng, H. Yao, and Y. Kuzyakov. 2023. Bio-converted organic wastes shape microbiota in maize rhizosphere: Localization and identification in enzyme hotspots. *Soil Biology and Biochemistry*, 184.
- Yang, M., Q. Li, G. Zhao, Y. Liu, and Y. Lou. 2025. Electrophysiological and Behavioral Responses of *Orchestes steppensis* (Coleoptera: *Curculionidae*) to *Ulmus* Plant Volatiles. *Plants*, 14(1).
- Yudistira, D. H., Y. U. Sandi, B. A. Wirabumi, A. Damayanti, and P. Wikandari. 2025. Effects of different application doses of black soldier fly frass on soybean plant performances and arthropod abundance. *Asian Journal of Agriculture*, 9(1): 40–51.
- Yuhendra, Y., Y. Syaukat, S. Hartoyo, dan N. Kusnadi. 2022.



Evaluasi Potensi Black Soldier Fly (*Hermetia illucens*) Frass Dalam Meningkatkan Kinerja Pertumbuhan

Dan Aktivitas Metabolit Sekunder Broad Beans (*Vicia faba L.*)

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