

DAFTAR PUSTAKA

- Adeyemi, M. M. H. 2010. The potential of secondary metabolites in plant material as deterrents against insect pest: a review. *African Jurnal Of Pure And Applied Chemistry*, 4(11): 243 –246.
- Afriyanita, Lina, E. C. & Darnetty. 2019. Aktivitas insektisida ekstrak air campuran buah *Piper aduncum* dan daun *Tephrosia vogelii* terhadap *Crocidolomia pavonana* Fabricius (Lepidoptera: Crambidae). *Jurnal Proteksi Tanaman*, 3(1): 34-46.
- Ahsol, H., Setiawati, W., Hudayya, A. & Luthfy. 2015. Sinergisme jamur entomopatogen *Metarhizium anisopliae* dengan insektisida kimia untuk meningkatkan mortalitas ulat bawang *Spodoptera exigua*. *J. Hort*, 26(2): 257-266.
- Amiruddin, M, Umrah & Alwi, M. 2012. Keefektifan *Metarhizium anisopliae* sebagai agensia pengendali hayati terhadap larva lalat *Musca domestica* L. *Biocelebes*, 6(1): 48-55.
- Anggraeni, T., Melanie, & Putra, R. E. 2011. Cellular and humoral immune defenses of *Oxya japonica* (Orthoptera: Acrididae) to entomopathogenic fungi *Metarhizium anisopliae*. *Entomological Research*, 41(1), 1–6.
- Arasu, M. V., Al Dhab, N. A., Saritha, V., Duraipandiyan, V., Muthukumar, C. & Kim, S. J. 2013. Antifeedant, larvicidal and growth inhibitory bioactivities of novel polyketide metabolite isolated from *Streptomyces* sp. AP-123 against *Helicoverpa armigera* and *Spodoptera litura*. *BMC Microbiol.*, 13(105).
- Arenas, R. O., Rivera, A., Aragon A., Parraguirre, Cabrera, E & Lopez, F. 2014. Evaluasi Kematian Armyworm (*Spodoptera frugiperda* JE Smith) dengan menggunakan *Metarhizium anisopliae* In vitro. *Jurnal Murni & Mikrobiologi Terapan*, Vol. 8 (2): 59-67.
- Arrese, E. L. & Soulages, J. L. 2010. Insect fat body: energy, metabolism, and regulation. *Annual Review of Entomology*, 55: 207–225.
- Assefa, F. & Ayalew, D. 2019. Status and control measures of fall armyworm (*Spodoptera frugiperda*) infestations in maizefields in Ethiopia: A review. *Cogent Food & Agriculture*, 5: 1641902.

- Awakawa, T. & Abe, I. 2021. Reconstitution of polyketide-derived meroterpenoid biosynthetic pathway in *Aspergillus oryzae*. *J. Fungi*, 7(468): 1-10.
- Bagariang, W., Tauruslina, E., Kulsum, U., Murniningtyas, T, Suyanto, H., Surono, Cahyana, N. A. & Mahmudah, D. 2020. Efektivitas insektisida berbahan aktif klorantraniliprol terhadap larva *Spodoptera frugiperda* (JE Smith). *Jurnal Proteksi Tanaman*, 4(1): 29-37.
- Balitbangtan. 2015. *Pedoman Umum Pengembangan Model Kawasan Mandiri Benih Padi, Jagung, dan Kedelai*. Badan Penelitian dan Pengembangan Pertanian. Kementerian Pertanian. Jakarta.
- Bay, M. M. & Anggraeni, T. 2016. Identifikasi tipe sel hemosit larva serangga *Trigona* sp. (Hymenoptera : Apidae) dan fungsinya terhadap pertahanan tubuh. *Bio-Edu : Jurnal Pendidikan Biologi*, 1(3): 39-41.
- Blaney, B., & Green, P. 1989. Insecticidal fungal metabolites: Cyclopiazonic acid and kojic acid contribute to the toxicity of “*Aspergillus flavus*” to sheep blowfly “*Lucilia cuprina*.” *General and Applied Entomology: The Journal of the Entomological Society of New South Wales*, 2: 49–50.
- CABI. 2017. *How to Identify Fall Armyworm*. Available from: <http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=29810>.
- Chapman, J. W., William, T., Escribano, A., Caballero, P., Cave, R. D. & Goulson, D. 1999. Fitness consequences of cannibalism in the fall armyworm, *Spodoptera frugiperda*. *Behavioral Ecology*, 10:298-303.
- Charnley, A. & Collins, S. A. 2007. *Entomopathogenic Fungi and Their Role in Pest Control*. In: Howard D.H., and Miller J.D. (eds.), *The Mycota IV: Environmental and Microbial Relationships*, Springer-Verlag, Berlin, Heidelberg.
- Cheong, P., Glare, T.R., Rostas, M., Haines, S.R. 2016. Measuring chitinase and protease activity in cultures of fungal entomopathogens. *Methods Mol Biol.*, 1477: 177-189.
- Claydon, N., Grove, J. F. & Pople, M. 1977. Insecticidal secondary metabolic products from the entomogenous fungus *Fusarium solani*. *J Inveretbr Pathol*, (30): 216-223.

- de Faria, M. R. & Wraight, S.P. 2007. Mycoinsecticides and Mycoacaricides: a comprehensive list with worldwide coverage and international classification of formulation types. *Biol Control*, 43: 237-256.
- Daba, G. M., Mostafa, F. A., & Elkhateeb, W. A. 2021. The ancient koji mold (*Aspergillus oryzae*) as a modern biotechnological tool. *Bioresources and Bioprocessing*, 8(1): 1-17.
- Dewanto, F. G., Londok, J. J. M. R., Tuturoong, R. A. V. & Kaunang, W. B. 2013. Pengaruh pemupukan anorganik dan organik terhadap produksi tanaman jagung sebagai sumber pakan. *Zootek*, 32(5): 1-8.
- Dono, D., Hidayat, S., Nasahi, C. & Anggraini, E. 2008. Pengaruh ekstrak biji *Barringtonia asiatica* L. (Kurz) (Lecythidaceae) terhadap mortalitas larva dan fekunditas *Crocidolomia pavonana* F. (Lepidoptera: Pyralidae). *Jurnal Agrikultura*, 19(1): 5-14.
- Dono, D., Hidayat, Y., Suganda, T., Hidayat, S. & Widayani, N. S. 2020. The toxicity of neem (*Azadirachta indica*), citronella (*Cymbopogon nardus*), castor (*Ricinus communis*), and clove (*Syzygium aromaticum*) oil against *Spodoptera frugiperda*. *Cropsaver*, 3(1): 22-30.
- Dwiastuti, M. E. & Kurniawati, M. Y. 2007. Keefektifan entomopatogen *Hirsutella citriformis* (Deuteromycetes: Moniliales) pada kutu psyllid *Diaphorina citri* Kuw. *J. Hort*, 17(3): 244-252.
- Enrique, Q. & Alain, V.E.Y. 2004, Bassiacridin, a protein toxic for locusts secreted by the entomopathogenic fungus *Beauveria bassiana*, *Mycol. Res.*, 108(4): 441-452.
- Fan, J. Q., Chen, X. R. & Hu, Q. B. 2013. Effects of destruxin A on hemocytes morphology of *Bombyx mori*. *Integr. Agric.*, 12(6): 1042-1048.
- Firdaus & Ulpah, S. 2016. Uji efektivitas beberapa konsentrasi larutan daun kirinyuh (*Chromolaena odorata* (L.) King & Robinson) terhadap ulat tritip (*Plutellaxylostella* L.) pada tanaman kubis (*Brassica oleraceae* var. *Capitata*) di laboratorium. *Jurnal Agribisnis*, 18(2): 132-141.
- Fitriana, Y., Suharjo, R., Swibawa, I.G. Semenguk, B., Pasaribu, L. T., Hartaman, M., Rwandini, R. A., Indriyati, Purnomo & Solikhin. 2021. *Aspergillus oryzae* and *Beauveria bassiana* as entomopathogenic fungi of *Spodoptera litura* Fabricius (Lepidoptera: Noctuidae) infesting corn in Lampung, Indonesia. *Egypt J Biol Pest Control*, 31(127): 1-12.

- Francis, F., Druart, F., Mavungu, J. D. D., De Boevre, M., De Saeger, S., & Delvigne, F. 2020. Biofilm mode of cultivation leads to an improvement of the entomotoxic patterns of two *Aspergillus* species. *Microorganisms*, 8(5): 1-14.
- Frisvad, J. C., Møller, L. L. H., Larsen, T. O., Kumar, R., & Arnau, J. 2018. Safety of the fungal workhorses of industrial biotechnology: update on the mycotoxin and secondary metabolite potential of *Aspergillus niger*, *Aspergillus oryzae*, and *Trichoderma reesei*. *Applied Microbiology and Biotechnology*, 102: 9481–9515.
- Fuad, C. 2017. Efektivitas Tiga Jenis Cendawan Entomopatogen Isolat Lokal terhadap Perkembangan Hama Pengisap Polong Kedelai *Nezaraviridula* (Hemiptera: Pentatomidae). *Tesis*. Fakultas Pertanian. Universitas Sumatera Utara, Medan.
- Goergen, G., Kumar, P., Sangkung, S., Togola, A. & Tamo, M. 2016. First report of outbreaks of the fall armyworm *Spodoptera frugiperda* (JE Smith) (Lepidoptera, Noctuidae), a new alien invasive pest in West and Central Africa. *Plos One*, 11(10).
- Gomez, K.A. & Gomez A.A. 1995. *Prosedur Statistik untuk Penelitian Pertanian Edisi Kedua*. UI Press. Jakarta.
- Gupta, A. & Gopal, M. 2002. Aflatoxin production by *Aspergillus flavus* isolates pathogenic to coconut insect pests. *World Journal of Microbiology & Biotechnology*, 18: 325–331.
- Hasegawa, Y., Fukuda, T., Hagimori, K. & Tomoda, H. 2007. Tensyucic Acids, New Antibiotics Produced by *Aspergillus niger* FKI-2342. *Chemical & Pharmaceutical Bulletin*, 55(9): 1338-1341.
- Hasyim, A., Setiawati, W., Hudayya, A. & Luthfy. 2016. Sinergisme jamur entomopatogen *Metarhizium anisopliae* dengan insektisida kimia untuk meningkatkan mortalitas ulat bawang *Spodoptera exigua*. *J. Hort*, 26(2): 257-266.
- Hautbergue, T., Jamin, E. L., Debrauwer, L., Puel, O., & Oswald, I. P. 2018. From genomics to metabolomics, moving toward an integrated strategy for the discovery of fungal secondary metabolites. *Natural Product Reports*, 35(2), 147–173.

- Herlinda, S., Oktareni, S. S., Suparman, Anggraini, E., Elfita, Setiawan, A., & Lakitan, B. 2019. Effect of Application of UV Irradiated *Beauveria bassiana* and *Metarhizium anisopliae* on Larval Weight and Mortality of *Spodoptera litura*. *Proceedings of the International Conference and the 10th Congress of the Entomological Society of Indonesia (ICCESI 2019)*, 64–70. Paris, France: Atlantis Press.
- Herminanto, Wiharsi & Sumarsono, T. 2004. Potensi ekstrak biji srikaya (*Annona squamosa* L.) untuk mengendalikan ulat krop kubis *Crociodolomia Pavonana* F. *Agrosains*, 6(1): 31-35.
- Herminanto. 2006. Pengendalian hama kubis *Crociodolomia pavonana* F. menggunakan ekstrak kulit buah jeruk. *Jurnal Pembangunan Pedesaan*, 6(3): 166-174.
- Hussain, A., Tian, M. Y., He, Y. R. & Ahmed, S. 2009. Entomopathogenic fungi disturbed the larval growth and feeding performance of *Ocinara varians* (Lepidoptera: Bombycidae) larvae. *J Insect Sci*, 16: 511–517.
- Hutagalung, R. P. S., Sitepu, S. F. & Marheni. 2021. Biologi Fall Armyworm (*Spodoptera frugiperda* J. E. Smith) (Lepidoptera: Noctuidae) di laboratorium. *Jurnal Pertanian Tropik*, 8(1): 1-10.
- Janli, D., Goretti, M. M., Purwanto, Artadana, I. B., Askitosari, T. D. 2017. Extraction and toxicity assay of mycotoxin from entomopathogenic fungi isolate of Kusuma Agrowisata Orchard Batu, Jawa Timur, Indonesia” in NRLS Conference Proceedings, *International Conference on Natural Resources and Life Sciences (2016)*, *KnE Life Sciences*, 63-74.
- Jin-cheng, Z., Wu, T., Liu, L., Yang, W. & He, L. 2014. EcR-RNAi and azadirachtin treatments induced the abnormal proleg development in *Spodoptera litura*. *Journal of East China Normal University*, 1: 133-142.
- Johnson, S. J. 1987. Migration and the life history strategy of the fall armyworm, *Spodoptera frugiperda* in the Western Hemisphere. *Insect Science and its Application*. 8:543–549.
- Kaiser, D., Bacher, S., Mène-Saffrané, L., & Grabenweger, G. 2018. Efficiency of natural substances to protect *Beauveria bassiana* conidia from UV radiation. *Pest Management Science*, 75(2), 556–563.

- Kamelia, M., Zein, S., Supriyadi & Chosyah, D. N. 2020. Kombinasi ekstrak *Cymbopogon nardus* L. dan *Nicotiana tabacum* sebagai insektisida nabati *Helopeltis antonii* Sign. *Agriprima*, 4(2): 128-135.
- Kapriyanto, Haryadi, N. T., Hasjim, S. 2014. Patogenesitas isolat cendawan *Metarhizium anisopliae* entomopatogen terhadap larva uret famili Scarabaeidae. *Berkala Ilmiah Pertanian*, 1(1):xx-xx.
- Karthi, S., Nathan, S. S., Kalaivani, K. Srinivasan, P. B., Chellappandian, M., Thanigaivel, A., Ponsankar, A., Sivanesh, H., Raja, V. C., Chantini, K, M. P. & Sundar, N. S. 2019. Comparative efficacy of two mycotoxins against *Spodoptera litura* Fab. and their non-target activity against *Eudrilus eugeniae* Kinb. *Ecotoxicology and Environmental Safety*, 183: 1-8.
- Kasumbogo, U. 2006. *Konsep Pengendalian Hama Terpadu*. Yogyakarta. Gadjah Mada University Press.
- Kaur, T., Kaur, J., Kaur, A., & Kaur, S. 2016. Larvicidal and growth inhibitory effects of endophytic *Aspergillus niger* on a polyphagous pest, *Spodoptera litura*. *Phytoparasitica*, 44(4): 465–476.
- Kaur, M., Chadha, P., Kaur, S., & Kaur, A. 2021. *Aspergillus flavus* induced oxidative stress and immunosuppressive activity in *Spodoptera litura* as well as safety for mammals. *BMC Microbiology*, 21(1): 1-12.
- Keller, N. P. 2015. Translating biosynthetic gene clusters into fungal armor and weaponry. *Nat. Chem. Biol*, 1: 671- 677.
- Kementerian Pertanian. 2019. Pengenalan Fall Armywarm (*Spodoptera frugiperda* J. E. Smith) Hama Baru pada Tanaman Jagung di Indonesia. Balai Penelitian Tanaman Serelia. Jakarta.
- Khaidir & Hendrival. 2013. Pengujian penghambatan aktivitas makan dari ekstrak daun *Lantana camara* L. (Verbenaceae) terhadap larva *Plutella xylostella* L. (Lepidoptera: Yponomeutidae). *Jurnal Floratek*, 8: 35-44.
- Khan, S., Guo, L., Maimaiti, Y., Mijit, M., Qiu, D. 2012. Entomopathogenic fungi as microbial biocontrol agent. *Molecular Plant Breeding*, 3(7): 63-79.
- Kojongian, I. Y., Rumokoy, L. J. M. & Pinaria, B. A. N. 2022. Respons hama *Spodoptera litura* F. terhadap pestisida botanis *Cymbopogon nardus* L. Rendl., *Pangium edule* Reinw., dan *Syzigium aromaticum* L. pada tanaman *Brassica olearacea* L. *Agri-SosioEkonomi Unsrat*, 18(1): 267-276.

- Korlina, E., Mahfud, C., Rachmawati, D., Sarwono & Fatimah, S. 2008. Pengkajian Efektifitas Cendawan *Beauveria bassiana* terhadap Perkembangan Hama dan Penyakit Tanaman Krisan. *Prosiding Seminar Pemberdayaan Petani Melalui Informasi dan Teknologi Pertanian*. KP. Mojosari-16 Juli 2008. Kerjasama BPTP Jatim, Faperta Unbra, Diperta Prov, Bappeda.
- Koswanudin, D. & T. E. Wahyono. 2014. Keefektifan bioinsektisida *Beauveria bassiana* terhadap hama wereng batang coklat (*Nilaparvata lugens*), walang sangit (*Leptocorisa oratorius*), pengisap polong (*Nezara viridula*) dan (*Riptortus linearis*). *Prosiding Seminar Nasional Pertanian Organik*. Bogor, 18-19 Juni 2014.
- Koul, O. 2008. Phytochemicals and insect control: An antifeedant approach. *Critical Reviews in Plant Sciences*, 27(1): 1–24.
- Kurnia D. 1998. Efektifitas *Beauveria bassiana* (Balsamo) Vuillemin dan *Metarhizium anisopliae* (Metchnikoff) Sorokin Serta Kombinasi Keduanya terhadap Larva *Spodoptera litura* F (Lepidoptera:Noctuidae). *Skripsi*. Padang. Universitas Andalas.
- Leatemia, J. A. & Rumthe, R. Y. 2011. Studi kerusakan akibat serangan hama pada tanaman pangan di Kecamatan Bula, Kabupaten Seram bagian timur, Propinsi Maluku. *Jurnal Agroforestri*, 6(1): 52-56.
- Lestari, S., Ambarningrum, T. B., & Pratiknyo, H. 2013. Tabel hidup *Spodoptera litura* Fabr. dengan pemberian pakan buatan yang berbeda. *J. Sains Vet*, 31(2), 166–179.
- Lina, E. C., Dadang, Manuwoto, S. & Syahbirin, G. 2015. Gangguan fisiologi dan biokimia *Crocidolomia pavonana* (F.) (Lepidoptera: Crambidae) akibat perlakuan ekstrak campuran *Tephrosia vogelli* dan *Piper aduncum*. *Jurnal Entomologi Indonesia*, 12(2): 94-101.
- Maharani Y., Dewi, V., Puspasari, L., Rizkie, L., Hidayat, Y. & Dono, D. 2019. Cases of fall army worm *Spodoptera frugiperda* J. E. Smith (Lepidoptera: Noctuidae) attack on maize in Bandung, Garut and Sumedang District, West Java. *Jurnal Cropsaver*, 2(1): 38-46.
- Mawarni, N. I. I., Erdiansyah, I. & Wardana, R. 2021. Isolasi cendawan *Aspergillus* sp. pada tanaman padi organik. *Agriprima*, 5(1): 68-74.

- Melanie, Miranti, M., Kasmara, H., Hazar, S., & Martina, A. 2018. Insecticidal activities of crude extract of *Metarhizium anisopliae* and conidia suspension against *Crociodolomia pavonana* fabricius. *IOP Conference Series: Earth and Environmental Science*, 166, 012017.
- Merkey, A. B., Wong, C.K., Hoshizaki, D.K., Gibbs, A.G. 2011. Energetics of metamorphosis in *Drosophila melanogaster*. *Journal of Insect Physiology*, 57: 1437–1445.
- Messchendorp, L. 1998. *Terpenoid Antifeedants Against Insects: A Behavioral and Sensory Study*. Landbouwniversiteit, Wageningen.
- Minarni, E. W., Soesanto, L., Suyanto, A. & Rostaman. 2021. Efektivitas metabolisme sekunder dari jamur entomopatogen untuk kontrol *Nilaparvata lugens* Stl. dalam skala laboratorium. *Jurnal Perlindungan Tanaman Indonesia*, 25(1): 86-97.
- Mishra, S., Kumar, P., & Malik, A. 2015. Effect of temperature and humidity on pathogenicity of native *Beauveria bassiana* Isolate against *Musca domestica* L. *Journal of Parasitic Disease*, 39(4), 697–704.
- Moekasan, T. K. & Murtiningsih, R. 2010. Pengaruh campuran insektisida terhadap ulat bawang *Spodoptera exigua* Hubn. *J. Hort.*, 20(1): 67-79.
- Moniharapon, D. D. & Moniharapon, M. 2014. Ekstrak etanol daun melinjo (*Gnetum gnemon* L.) sebagai *anti feedant* terhadap larva ulat grayak (*Spodoptera litura* Fab.) pada tanaman sawi (*Brassica sinensis* L.). *Jurnal Budidaya Pertanian*, 10(2): 100-104.
- Montezano, D., Specht, A., Sosa-Gomez, D., Roque-Specht, V., Sousa-Silva, J., Paula-Moraes, S., Peterson, J. & Hunt, T. 2018. Host plants of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas. *African Entomology*, 26(2): 286-300.
- Montezano, D. G., Specht, A., Gomez, D. R. S., Sprecht, V. F. R., Malaquias, J. V., Moraes, S. V. P., Peterson, J. A. & Hunt, T. E. 2019. Biotic potential and reproductive parameters of *Spodoptera frugiperda* (J. E. Smith, 1797) (Lepidoptera: Noctuidae). *Journal of Agricultural Science*, 11(13): 240-252.
- Murniasih, T. 2003. Metabolit sekunder dari spons sebagai bahan obat-obatan. *Jurnal Oseana*, 28(3): 27–33.

- Muta'ali, R. & Purwani, K. I. 2015. Pengaruh ekstrak daun beluntas (*Pluchea indica*) terhadap mortalitas dan perkembangan larva *Spodoptera litura* F. *Jurnal Sains dan Seni ITS*, 4(2): 55-58.
- Namara, L. M., Dolan, S. K., Walsh, J. M. D., Stephens, J. C., Glare, T. R., Kavanagh, K. & Griffin, C. T. 2019. Oosporein, an abundant metabolite in *Beauveria caledonica*, with a feedback induction mechanism and a role in insect virulence. *Fungal Biology*, 123: 601-610.
- Nijhout, H.F., Riddiford, L. M., Mirth, C., Shingleton, A. W., Suzuki, Y., Callier, V. 2014. The developmental control of size in insects. *WIREs Developmental Biology*, 3: 113–134.
- Nonci, N., Kalqutny, S. H., Mirsam, H., Muis, A., Azrai, M. & Aqil, M. 2019. *Pengenalan Fall Armyworm (Spodoptera frugiperda J. E. Smith) Hama Baru pada Tanaman Jagung*. Balai Penelitian Tanaman Serealia. Maros.
- Noviana, E., Sholahuddin & Widadi, S. 2012. Uji potensi ekstrak daun suren (*Toonasureni*) sebagai insektisida ulat grayak (*Spodoptera litura*) pada tanaman kedelai. *Biofarmasi*, 10(2): 46-53.
- Panikkai, S., Nurmalina, R., Mulatsih, S. & Purwati, H. 2017. Analisis ketersediaan jagung nasional menuju pencapaian swasembada dengan pendekatan model dinamik. *Informatika Pertanian*, 26(1): 41 - 48.
- Permana, R. E. S., Moerfiah & Triastinurmiatiningsih. 2018. Potensi ekstrak daun karuk (*Piper sarmentosum*) sebagai insektisida nabati hama ulat grayak (*Spodoptera litura*). *Ekologia: Jurnal Ilmiah Ilmu Dasar dan Lingkungan Hidup*, 18(2): 55-62.
- Permatasari, G. A., Hariani, N. & Trimurti, S. 2020. Uji mortalitas ulat grayak (*Spodoptera litura* F.) terhadap ekstrak tanaman lidah mertua (*Sansevieria trifasciata* Prain). *Jurnal Bioterdidik*, 8(3): 56-68.
- Permatasari, S. C. & Asri, M. T. 2021. Efektivitas ekstrak ethanol daun kirinyuh (*Eupatorium odoratum*) terhadap mortalitas larva *Spodoptera litura*. *LenteraBio Berkala Ilmiah Biologi*, 10(1): 17-24.
- Plessis, H. D., Berg, J. V. D., Ota, N., Kriticos, J. D. 2018. *Spodoptera frugiperda (Fall Armyworm)*. Pest Geography. University of Queensland. Australia.

- Powell, K. A., Renwick, A. & Peberdy, J. F. 2013. *The Genus Aspergillus: From Taxonomy and Genetics to Industrial Application*. Springer Science & Business Media, Berlin.
- Prabowo, H. 2010. Pengaruh ekstrak daun *Nerium oleander* L. terhadap mortalitas dan perkembangan hama *Spodoptera litura* Fab. *Jurnal Biota*, 15 (3):426.
- Prasanna, B., Joseph E., Huesing, Eddy, R. & Peschke, V. 2018. *Fall Armyworm in Africa: A Guide for Integrated Pest Management, First Edition*. Mexico: CDMX CIMMYT.
- Prayogo, Y. & Tengkan, W. 2004. Pengaruh konsentrasi dan frekuensi aplikasi *Metarhizium anisopliae* isolat kendalpayak terhadap tingkat kematian *Spodoptera litura*. *Sainteks. Jurnal Ilmiah Ilmu-Ilmu Pertanian*, 3(10): 209-216.
- Prayogo, Y. 2006. Sebaran dan efikasi berbagai genus cendawan entomopatogen terhadap *Riptortus linearis* pada kedelai di Lampung dan Sumatra Selatan. *J. HPT Tropika*, 6(1): 14-22.
- Prijono. 1998. Insecticidal Activity of Meliaceous seed extracts against *Crocidolomia binotalis* Zeller (Lepidoptera : Pyralidae). *Bul. HPT*, 9(1): 7-13.
- Prijono. 1999. *Prinsip-prinsip Uji Hayati*. Dalam : B.W. Nugroho, Dadang & D. Prijono (eds). *Bahan Pelatihan Pengembangan dan Pemanfaatan Insektisida Alami. Pusat Kajian Pengendalian Hama Terpadu*. IPB. hal. 45 - 62.
- Prijono, D. 2005. *Pengembangan dan Pemanfaatan Insektisida Botani (Bahan Pelatihan)*. Departemen Proteksi Tanaman. Institut Pertanian Bogor. Bogor.
- Quesada-Moraga, E. & Vey A. 2004. Bassiacridin, a protein toxic for locusts secreted by the entomopathogenic fungus *Beauveria bassiana*. *Mycological Research* 108: 441-452.
- Quin, M. B., Flynn, C. M. & Schmidt-Dannert, C. 2014. Traversing the fungal terpenome. *Nat. Prod. Rep*, 3:1449-1473.
- Rahma, R. A., Widjanarko, S. B., Sunaryanto, R. & Yuniarta. 2015. Optimasi media fermentasi *Aspergillus oryzae* penghasil antijamur patogen buah kakao *Phytophthora palmivora*. *Agritech*, 35(3): 315-323.

- Ramadhan, R. A. M., Puspasari, L. T., Meliansyah, R., Maharani, R., Hidayat, Y. & Dono, D. 2016. Bioaktivitas formulasi minyak biji *Azadirachta indica* (A. Juss) terhadap *Spodoptera litura* F. *Jurnal Agrikultura*, 27 (1): 1-8.
- Ramos, Y., Taibo, A. D., Jimenez, J. A. & Portal, O. 2020. Pembentukan endofit *Beauveria bassiana* dan *Metarhizium anisopliae* pada tanaman jagung dan pengaruhnya terhadap larva *Spodoptera frugiperda* (JE Smith) (Lepidoptera: Noctuidae). *Jurnal Mesir Pengendalian Hama Biologis*, 30:20.
- Razak, T. A., Santhakumar, T., Mageswari, K., & Santhi, S. 2014. Studies on efficacy of certain neem products against *Spodoptera litura* (Fab.). *J Biopest*, 7:160-163.
- Rios-Moreno, I. Garrido-Jurado, M.C. Raya-Ortega, E. Quesada-Moraga. 2017. Quantification of fungal growth and destruxin A during infection of *Galleria mellonella* larvae by *Metarhizium brunneum*. *Journal of Invertebrate Pathology*, 149(1): 29-35.
- Roberts D. W. & Humber, R. A. 1981. *Entomogenous Fungi*. In: Cole, G.T., Kendrick B. (eds.). *Biology of Conidial Fungi*. Academic Press. New York.
- Rosmiati, A., Hidayat, C., Firmansyah, E. & Setiati, Y. 2018. Potensi *Beauveria bassiana* sebagai agens hayati *Spodoptera litura* Fabr. pada tanaman kedelai. *Jurnal Agrikultura*, 29(1): 43-47.
- Rosmini & Lasmin, S. A. 2010. Identifikasi cendawan entamopatogen lokal dan tingkat patogenitasnya terhadap hama. *Jurnal Agroland*, 17(3): 205-212.
- Rusdy, A. 2009. Efektivitas ekstrak nimba dalam pengendalian ulat grayak (*Spodoptera litura* Fabr.) pada tanaman selada. *Jurnal Floratek*, 4(1): 41-54.
- Safirah, R., Widodo, N. & Budiyanto. 2016. Uji efektifitas insektisida nabati buah *Crescentia cujete* dan bunga *Syzygium aromaticum* terhadap mortalitas *Spodoptera litura* secara *in vitro* sebagai sumber belajar biologi. *Jurnal Pendidikan Biologi Indonesia*, 2(3): 265-276.
- Salimova, D., Dalinova, A., Dubovik, V., Senderskiy, I., Stepanycheva, E., Tomilova, Hu, Q., Berestetskiy, A. 2021. Entomotoxic activity of the extracts from the fungus, *Alternaria tenuissima* and its major metabolite, Tenuazonic Acid. *J. Fungi*, 7(774): 1-22.

- Samia, R. R., de Olivera, R. L., Moscardini, V. F. & Carvalho, G. A. 2016. Effects of aqueous extracts of *Copaifera langsdorffii* (Fabaceae) on the growth and reproduction of *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae). *Neotrop Entomol*, 1-8.
- Sánchez-Pérez, L., Rodríguez-Navarro, S., Marín-Cruz, V.H., Ramos-López, M.N., Ramos, A.P., & Barranco-Florido, J.E. 2016. Assessment of *Beauveria bassiana* and their enzymatic extracts against *Metamasius spinolae* and *Cyclocephala lunulata* in laboratory. *Advances in Enzyme Research*, 4(3): 98–112.
- Sapdi. 1999. Mortalitas nimfa *Nezara viridula* pada beberapa tingkat konsentrasi suspensi cendawan *Beauveria bassiana*. *Agrivita*, 3:1.
- Sari, M., Lubis, L. & Pangestiningih, Y. 2013. Uji efektivitas beberapa insektisida nabati untuk mengendalikan ulat grayak (*Spodoptera litura* F.) (Lepidoptera: Noctuidae) di laboratorium. *Jurnal Online Agroteknologi*, 1(3): 560-569.
- Scapinello, J., de Oliviera, J. V., Chiaradia, L. A., Junior, O. T., Niero, R. & Magro, J. D. 2014. Insecticidal and growth inhibiting action of the supercritical extracts of *Melia azedarach* on *Spodoptera frugiperda*. *Bras. Eng. Agric. Ambiental*, 18(8): 866-872.
- Sidauruk, L., Manalu, C. J. & Sinukaban, D. E. A. V. 2020. Efektifitas pestisida nabati dengan berbagai konsentrasi pada pengendalian serangan hama dan produksi tanaman jagung manis (*Zea mays saccharata* Sturt). *Jurnal Ilmiah Rhizobia*, 9(1): 24-32.
- Sharanabasappa, Kalleswaraswamy, C., Maruti, M. & Pavithra, H. 2018. Biology of Invasive Fall Army Worm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) On Maize. *Indian Journal of Entomology*, 80(3): 540-543.
- Shinta, A., Wigiati, Y., & Sukowati, S., 2012. Efektifitas larvasida altosid 1,3G terhadap *Aedes aegypti* di laboratorium. *Bul. Penelit. Kesehat*, 39(3): 110-118.
- Sisay, B., Tefera, T., Wakgari, M., Ayalew, G. & Mendesil, E. 2019. The efficacy of selected synthetic insecticides and botanicals against fall armyworm, *Spodoptera frugiperda*, in maize. *Insects*, 10(45): 1-14.
- Soesanto, L. 2015. *Metabolit Sekunder Agensia Pengendali Hayati: Terobosan Baru Pengendalian Organisme Pengganggu Tanaman Perkebunan*. Fakultas pertanian, Universitas Jenderal Soedirman. Purwokerto.

- Soesanto, L. 2017. *Pengantar Pestisida Hayati: Adendum Metabolit Sekunder Agensia Hayati*. Raja Grafindo Persada : Jakarta.
- Soesanto, L., Fatihah, B., Manan, A., Mugiastuti, E. & Prihatiningsih, N. 2020. Organic control of *Bemisia tabaci* Genn. on *Capsicum annuum* with entomopathogenic fungi raw secondary metabolites. *Biodiversitas*, 21(12): 5786-5791.
- Soltani, J. 2016. Secondary metabolite diversity of the genus *Aspergillus*: recent advances. *New and Future Developments in Microbial Biotechnology and Bioengineering*, 275-292.
- Sparks, A. N. 1979. A review of the biology of the fall armyworm. *Florida Entomologist*. 62: 82-87.
- Specht, A., Montezano, D. G., Sosa-Gómez, D. R., Paula-Moraes, S.V., Roque-Specht, V. F., Barros, N. M. 2015. Reproductive potential of *Spodoptera eridania* (Stoll) (Lepidoptera: Noctuidae) in the laboratory: effect of multiple couples and the size. *Brazilian Journal of Biology*, 76: 526–230.
- Squira, R. A. 1989 Ranking animal carcinogens: a proposed regulatory approach. *Science*, 214: 887–891.
- Strasser, H., Vey A. & Butt T. 2000. Are there any Risks in Using Entomopathogenic Fungi for Pest Control, with Particular Reference to the Bioactive Metabolites of *Metarhizium*, *Tolypocladium* and *Beauveria* species. *Biocontrol Science and Technology*. 10: 717-735.
- Subiono, T. 2019. *Spodoptera frugiperda* (Lepidoptera: Noctuidae) pada beberapa sumber pakan. *Jurnal Agroekoteknologi Tropika Lembab*, 2(2): 130-134.
- Supriyadi, D., Pasar, F. & Lakani, I. 2017. Efikasi jamur *Aspergillus* sp. terhadap hama penghisap buah kakao *Helopeltis* sp. (Hemiptera : Miridae) pada tanaman kakao. *Jurnal Agrotekbis*, 5(3): 300–307.
- Suryani, A. I., Hariani, N., Majid, A. F. & Risqa, S. 2017. Persentase mortalitas ulat grayak terhadap pemberian ekstrak daun bunga pukul empat. *Jurnal Bionature*, 18(2): 118-122.
- Sya'diyah, N.A., Purwani, K. I. & Wijayawati, L. 2013. Pengaruh ekstrak daun bintaro (*Cerbera odollam*) terhadap perkembangan ulat grayak (*Spodoptera litura* F.). *Jurnal Sains dan Seni Pomits*, 2(2): 111-115.

- Syah, B. W. & Purwani, K. I. 2016. Pengaruh ekstrak daun belimbing wuluh (*Averrhoa bilimbi*) terhadap mortalitas dan perkembangan larva *Spodoptera litura*. *Jurnal Sains dan Seni ITS*, 5(2): 23-28.
- Syahputra, E. 2007. Aktivitas sediaan insektisida *Calophyllum soulattri* terhadap reproduksi dan oviposisi *Crocidolomia pavonana*. *Jurnal Agrikultura*, 18(2): 105-110.
- Tambingsila, M. & Hidayat, R. 2015. Uji efektivitas cendawan *Fusarium* sp potensinya sebagai entomopatogen terhadap kepik pengisap buah kakao (*Helopeltis sulawesi* : Hemiptera). *Jurnal AgroPet*, 12(2): 10-16.
- Taufika, R., Sumarmi, S. & Nugroho, S. A. 2020. Efek subletal campuran ekstrak daun srikaya (*Annona squamosa* L.) dan rimpang kunyit (*Curcuma domestica* Val.) terhadap larva *Spodoptera litura* F. *AGROMIX*, 11(1), 66-78.
- Teetor-Barsch, G.H. & D.W. Roberts. 1983. Entomogenous *Fusarium* species. *Mycopathology*, (84): 3-16.
- Trisyono, Y., Suputa, Aryuwandari V., Hartaman, M. & Jumari. 2019. Occurrence of heavy infestation by the fall armyworm *Spodoptera frugiperda*, a new alien invasive pest, in corn in Lampung Indonesia. *Jurnal Perlindungan Tanaman Indonesia*, 23(1): 156-160.
- Trizelia, Nurbailis, Ernawati, D. 2013. Virulensi berbagai isolat jamur entomopatogen *Metarhizium* spp. terhadap hama penggerek buah kakao *Conopomorpha cramerella* Snell. (Lepidoptera: Gracillariidae). *J. HPT Tropika*, 13(2): 151-158.
- Umemura, M., Kuriwa, K., Dao, L. V., Okuda, T. & Terai, G. 2020. Promoter tools for further development of *Aspergillus oryzae* as a platform for fungal secondary metabolite production. *Fungal Biology and Biotechnology*, 7(1): 1-9.
- Valencia, J.W.A., Gaitán Bustamante, A.L., Jiménez, A.V., & Grossi-de-Sá, M.F. 2011. Cytotoxic activity of fungal metabolites from the pathogenic fungus *Beauveria bassiana*: An intraspecific evaluation of beauvericin production. *Current Microbiology*, 63(3), L306–312.
- Vey, A, Hoagland, R. E. & Butt, T. M. 2001. *Toxic Metabolites of Fungal Biocontrol Agents. Fungi as Biocontrol Agents. Progress, Problems and Potential* (Butt TM, Jackson C & Magan N, eds), pp. 311-346. CABI Publishing, Oxford, UK.

- Weichen, Y., Xiaoyu, L., Xiankun, L., Yuanqing, C., Xiaofei, W., Pei, L. & Rimao, H. 2022. Synthesis and insecticidal activity of tenuazonic acid and derivatives. *Chinese Journal of Pesticide Science*, 24(2): 260-271.
- Wicklow, D. T., Dowd, P. F. & Gloer, J. B. 1994. *Antiinsectan Effects of Aspergillus Metabolites*. Federation of European Microbial Societies Symposium Series. Springer. Boston.
- Widariyanto, R., Pinem, M. I., & Zahara, F. 2017. Patogenitas beberapa jamur entomopatogen (*Lecanicillium lecanii*, *Metarhizium anisopliae*, dan *Beauveria bassiana*) terhadap *Aphis glycines* pada tanaman kedelai. *Agroekoteknologi*, 5(2337): 8–16.
- Wigglesworth, V.B. 1974. *Insect Physiology*. Chapman and Hall. London.
- Wright, S., Ramos, M., Avery, P., Jaronski, S. & Vandenberg, J. 2010. Comparative virulence of *Beauveria bassiana* isolates against Lepidopteran pests of vegetable crops. *Journal of Invertebrate Pathology*, 103(2010): 186-199.
- Yanuwiadi, B., Leksono, A. S., Guruh, H. H., Fathoni, M. & Bedjo. 2013. Potensi ekstrak daun sirsak, biji sirsak dan biji mahoni untuk pengendalian ulat grayak (*Spodoptera litura* L.). *Natural*, 2(1): 88-93.
- Yudiawati, E. 2019. Efektivitas insektisida nabati ekstrak kulit buah jeruk nipis (*Citrus aurantifolia*) terhadap larva *Spodoptera exigua* Hubner. (Lepidoptera: Noctuidae) di laboratorium. *Jurnal Sains Agro*, 4(2): 1-6.
- Zaman, S., Hasan, M., Ahmad, F., & Javed, N. 2020. Pathogenicity of entomopathogenic fungi against *Sitophilus granarius* (L.) (Coleoptera: Curculionidae) under abiotic factors. *Pakistan Journal of Agricultural Sciences*, 57(1), 79–86.
- Zarkani, A., Prijono, D & Pudjianto. 2009. Pengujian ekstrak *Piper retrofractum* insektisida nabatiterhadap *Crocidolomia pavonana* dan *Plutella xylostella* sertakeamanannya terhadap *Diadegma semiclausum*. *Jurnal Akta Agrosia*, 12(1): 35-44.
- Zhang, P., You, Y., Song, Y., Wang, Y. & Zhang, L. 2015. First record of *Aspergillus oryzae* (Eurotiales: Trichocomaceae) as an entomopathogenic fungus of the locust, *Locusta migratoria* (Orthoptera: Acrididae). *Biocontrol Science and Technology*, 25(11): 1-20.

Zhang, L., Fasoyin, O.E., Molnár, I., & Xu, Y. 2020. Secondary metabolites from *Hypocrealean entomopathogenic fungi*: Novel bioactive compounds. *Natural Product Reports*, 37(9), 1181– 1206.

Zulaiha, S., Suprpto & Apriyanto, D. 2012. Infestasi beberapa hama penting terhadap jagung hibrida pengembangan dari jagung lokal Bengkulu pada kondisi input rendah di dataran tinggi andisol. *Jurnal Penelitian Pengelolaan Sumberdaya Alam dan Lingkungan*, 1(1): 15-28.

