

## DAFTAR PUSTAKA

- Afriani, A., Heviyanti, M., dan Harahap, F. S. (2019). Efektivitas *Gliocladium virens* untuk mengendalikan penyakit *Fusarium oxysporum* f. sp. *capsici* pada tanaman cabai. *Jurnal Pertanian Tropik* 6(3): 403-411.
- Agrios, G. N. (2005). *Plant Pathology*. 5th ed. Burlington, USA: Elsevier Academic Press.
- Agustina, F., Wahyudin, N., dan Purwasih, R. (2022). Optimalisasi produksi cabai merah di Kabupaten Bangka Tengah. *Society* 10(1): 67-76.
- Albana, H. (2023). Potensi beberapa sediaan *Trichoderma harzianum* untuk pengendalian penyakit layu fusarium dan pertumbuhan tanaman cabai. Skripsi. Fakultas Pertanian. Universitas Andalas.
- Almagro, L., Gómez Ros, L. V., Belchi-Navarro, S., Bru, R., Ros Barceló, A., and Pedreño, M. A. (2009). Class III peroxidases in plant defence reactions. *Journal of experimental botany* 60(2): 377-390.
- Anggraini, K., Yuliadhi, K. A., dan Widaningsih, D. (2018). Pengaruh populasi kutu daun pada tanaman cabai besar (*Capsicum Annuum* L.) terhadap hasil panen. *Jurnal Agroekoteknologi Tropika* 7(1): 113-121.
- Appu, M., Ramalingam, P., Sathiyanarayanan, A., and Huang, J. (2021). An overview of plant defense-related enzymes responses to biotic stresses. *Plant Gene* 27: 1-8.
- APS, (2024). Plant Disease Epidemiology: Temporal Aspects Modelling Disease Progress.  
<https://www.apsnet.org/edcenter/disimpactmngmnt/topic/EpidemiologyTemporal/Pages/ModellingProgress.aspx> di akses pada 1 November 2024.
- Arie, T. (2019). Fusarium diseases of cultivated plants, control, diagnosis, and molecular and genetic studies. *Journal of pesticide science* 44(4): 275-281.
- Badan Pusat Statistik (BPS). (2024). *Luas panen tanaman sayuran menurut provinsi dan jenis tanaman*. SPH/BPS-Statistics Indonesia.
- Brueske, C.H. (1980) Phenylalanine ammonia lyase activity in tomato roots infected and resistant to the root-knot nematode (*Meloidogyne incognita*). *Physiol Plant Path* 16:409–414.
- Bunsangiam, S., Thongpae, N., Limtong, S., and Srisuk, N. (2021). Large scale production of indole-3-acetic acid and evaluation of the inhibitory effect of indole-3-acetic acid on weed growth. *Scientific Reports* 11(1): 13094.
- Cai, W. J., Ye, T. T., Wang, Q., Cai, B. D., and Feng, Y. Q. (2016). A rapid approach to investigate spatiotemporal distribution of phytohormones in rice. *Plant Methods* 12(1): 1-10.
- Cardarelli, M., Woo, S. L., Roush, Y., and Colla, G. (2022). Seed treatments with microorganisms can have a biostimulant effect by influencing germination and seedling growth of crops. *Plants* 11(3): 259.

- Centre for Agriculture and Bioscience International (CABI). (2022). *Fusarium oxysporum* (basal rot). In: Invasive Species Compendium Wallingford, UK: CAB International. [www.cabi.org/isc](http://www.cabi.org/isc) [diakses 28 September 2022].
- Chaman, M. E., Copaja, S. V., and Argandoña, V. H. (2003). Relationships between salicylic acid content, phenylalanine ammonia-lyase (PAL) activity, and resistance of barley to aphid infestation. *Journal of Agricultural and Food Chemistry* 51(8): 2227-2231.
- Datta, D., Senapati, A. K., Behera, L., Zaidi, N. W., Kumar, S., & Dey, P. (2023). Alleviating drought stress in rice plant through intervention of *Trichoderma* spp. *Journal of Environmental Biology* 44(3): 373-379.
- Davies, P. J. (2010). *Plant hormones: biosynthesis, signal transduction, action.* Dordrecht: Springer Netherlands.
- Delaunois, B., Jeandet, P., Clément, C., Baillieul, F., Dorey, S., and Cordelier, S. (2014). Uncovering plant-pathogen crosstalk through apoplastic proteomic studies. *Frontiers in plant science* 5: 1-18.
- Dewi, A. A., Ainurrasjid, A., dan Saptadi, D. (2016). Identifikasi ketahanan tujuh genotip cabai rawit (*Capsicum frutescens* L.) terhadap *Phytophthora capsici* (penyebab penyakit busuk batang): Disertasi, Universitas Brawijaya.
- Dewi, E., Rosmana, A., and Kuswinanti, T. (2021). The use of endophyte fungal isolates in controlling *Fusarium oxysporum*, the causal agent of wilt disease on chilli (*Capsicum annuum*). In *IOP Conference Series: Earth and Environmental Science* (Vol. 807, No. 2, p. 022104). IOP Publishing.
- Duriat, A. S., Gunaeni, N., dan Wulandari, A. W. (2007). *Penyakit penting pada tanaman cabai dan pengendaliannya*. Balai Penelitian Tanaman Sayuran.
- Druzhinina, I. S., Seidl-Seiboth, V., Herrera-Estrella, A., Horwitz, B. A., Kenerley, C. M., Monte, E., ... and Kubicek, C. P. (2011). *Trichoderma*: the genomics of opportunistic success. *Nature reviews microbiology* 9(10): 749-759.
- Ferniah, R. S., Daryono, B. S., Kasiamdari, R. S., and Priyatmojo, A. (2014). Characterization and pathogenicity of *Fusarium oxysporum* as the Causal Agent of fusarium wilt in chili (*Capsicum annuum* L.). *Microbiology Indonesia*. 8(3): 121-126.
- Fu, S. F., Wei, J. Y., Chen, H. W., Liu, Y. Y., Lu, H. Y., and Chou, J. Y. (2015). Indole-3-acetic acid: A widespread physiological code in interactions of fungi with other organisms. *Plant signaling & behavior* 10(8): e1048052.
- Gomes, E. V., Costa, M. D. N., de Paula, R. G., Ricci de Azevedo, R., da Silva, F. L., Noronha, E. F., ... and Nascimento Silva, R. (2015). The Cerato-Platinin protein Epl-1 from *Trichoderma harzianum* is involved in mycoparasitism, plant resistance induction and self cell wall protection. *Scientific Reports* 5(1): 17998.
- Hadameon, B., Rachmawati, R., and Sandy, Y. A. (2023). Exploration of Indole-3-Acetic Acid (IAA)-producing rhizosphere fungi in environmentally friendly and conventional cabbage fields at the ub agrotechnopark. *Journal of Tropical Plant Protection*, 4(1): 38-50.

- Hapshoh, S. (2016). Pewarisan karakter kualitatif dan kuantitatif pada persilangan cabai besar dan cabai rawit serta ketahanannya terhadap penyakit layu fusarium. Tesis. Sekolah Pascasarjana. IPB (Institut Pertanian Bogor).
- Hasari, S. A., Temaja, I. G. R. M., Sudiarta, I. P., dan Wirya, G. N. A. S. (2018). Efektivitas *Trichoderma* sp. Yang ditambahkan pada kompos daun untuk pengendalian penyakit layu fusarium pada tanaman stroberi (*Fragaria* sp.) di Desa Pancasari Kabupaten Buleleng. *Jurnal Agroekoteknologi Tropika* 7(3): 437-446.
- Hermeria, N., Yanti, Y., dan Khairul, U. (2021). Konsorsium *Bacillus* spp. untuk pengendalian *Sclerotium rolfsii* pada tanaman cabai (*Capsicum annuum* L.). dalam sistem usaha tani terpadu untuk ketahanan pangan mendukung pertanian berkelanjutan. Padang. Prosiding Seminar Nasional Faperta. 310-318.
- Ikrarwati., Sutardi, S., Mayasari, K., dan Sugiarti, M. (2018). *Budidaya cabai di perkotaan*. Cetakan Ketiga. Jakarta. Balai Pengkajian Teknologi Pertanian (BPTP). 32 hal.
- Inoue, I., Namiki, F. and Tsuge T. (2002). Plant colonization by the vascular wilt fungus *Fusarium oxysporum* requires FOW1, a gene encoding a mitochondrial protein. *The Plant Cell* 14:1869-1883.
- Islam, M. R., Chowdhury, R., Roy, A. S., Islam, M. N., Mita, M. M., Bashar, S., ... & Latif, M. A. (2023). Native *Trichoderma* induced the defense-related enzymes and genes in rice against *Xanthomonas oryzae* pv. *oryzae* (Xoo). *Plants* 12(9): 1864.
- Jhonson, E.A. (1946). An improved slide culture technique for the study and identification of pathogenic fungi. *Jurnal Bacteriology* 51(6): 689-694.
- Joshi R. (2018). A review of *Fusarium oxysporum* on its plant interaction and industrial use. *J Med Plants Stud* 6: 112-115.
- Kim, D. S., and Hwang, B. K. (2014). An important role of the pepper phenylalanine ammonia-lyase gene (PAL1) in salicylic acid-dependent signalling of the defence response to microbial pathogens. *Journal of experimental botany* 65(9): 2295-2306.
- Kthiri, Z., Jabeur, M. B., Machraoui, M., Gargouri, S., Hiba, K., and Hamada, W. (2020). Coating seeds with *Trichoderma* strains promotes plant growth and enhance the systemic resistance against Fusarium crown rot in durum wheat. *Egyptian Journal of Biological Pest Control* 30: 1-10.
- Kurnia, A. T., Pinem, M. I., dan Oemry, S. (2014). Penggunaan jamur endofit untuk mengendalikan *Fusarium oxysporum* f. sp. *capsici* dan *Alternaria solani* secara in vitro. *Agroekoteknologi* 2(4): 1596-1606.
- Lei, Z. H. A. O., and Zhang, Y. Q. (2015). Effects of phosphate solubilization and phytohormone production of *Trichoderma asperellum* Q1 on promoting cucumber growth under salt stress. *Journal of Integrative Agriculture* 14(8): 1588-1597.

- Lestiyani, A. 2015. Identifikasi, patogenititas, dan variabilitas penyebab penyakit moler pada bawang merah. Tesis. Universitas Gadjah Mada. Yogyakarta
- Li, M. F., Li, G. H., and Zhang, K. Q. (2019). Non-volatile metabolites from *Trichoderma* spp. *Metabolites* 9(3): 58.
- Lyons, R., Rusu, A., Stiller, J., Powell, J., Manners, J. M., and Kazan, K. (2015). Investigating the association between flowering time and defense in the *Arabidopsis thaliana*-*Fusarium oxysporum* interaction. *PloS one* 10(6):1-24.
- MacDonald, M. J., and D'Cunha, G. B. (2007). A modern view of phenylalanine ammonia lyase. *Biochemistry and Cell Biology* 85(3): 273-282.
- Mai, V. C., Drziewiecka, K., Jeleń, H., Narożna, D., Rucińska-Sobkowiak, R., Kęsy, J., ... Morkunas, I. (2014). Differential induction of *Pisum sativum* defense signaling molecules in response to pea aphid infestation. *Plant Science*, 221-222, 1–12.
- Martínez-Medina, A., Fernández, I., Sánchez-Guzmán, M. J., Jung, S. C., Pascual, J. A., and Pozo, M. J. (2013). Deciphering the hormonal signalling network behind the systemic resistance induced by *Trichoderma harzianum* in tomato. *Frontiers in Plant Science* 4: 1-12.
- Matthews, A., Muthukumar, S. P., Hamill, S., Aitken, E. A., and Chen, A. (2023). Impact of inoculum density of *Fusarium oxysporum* f. sp. *zingiberi* on symptomatic appearances and yield of ginger (*Zingiber officinale* Roscoe). *Access Microbiology* 5(9): 000605-v3.
- Meilin, A. (2014). *Hama dan penyakit pada tanaman cabai serta pengendaliannya*. Jambi. Balai Pengkajian Teknologi Pertanian Jambi.
- Melta, R.C. (2020). Efektivitas lama perendaman benih cabai (*Capsicum annuum* L.) dengan *Trichoderma asperellum* untuk pengendalian jamur patogen tular benih. Skripsi. Fakultas Pertanian. Universitas Andalas.
- Mishra, N., Jiang, C., Chen, L., Paul, A., Chatterjee, A., and Shen, G. (2023). Achieving abiotic stress tolerance in plants through antioxidative defense mechanisms. *Frontiers in Plant Science* 14: 1110622.
- Mishra, R. K., Pandey, S., Hazra, K. K., Mishra, M., Naik, S. S., Bohra, A., ... & Singh, N. P. (2023). Biocontrol efficacy and induced defense mechanisms of indigenous *Trichoderma* strains against *Fusarium* wilt [*F. udum* (Butler)] in pigeonpea. *Physiological and Molecular Plant Pathology* 127: 102122.
- Mohamed, B. F., Sallam, N. M., Alamri, S. A., Abo-Elyousr, K. A., Mostafa, Y. S., and Hashem, M. (2020). Approving the biocontrol method of potato wilt caused by *Ralstonia solanacearum* (Smith) using *Enterobacter cloacae* PS14 and *Trichoderma asperellum* T34. *Egyptian Journal of Biological Pest Control* 30: 1-13.
- Mogea, R. A., Putri, W. I. C. L. H., dan Abubakar, H. (2022). Isolasi bakteri penghasil indole acetic acid pada tanaman hortikultura di Perkebunan Prafi SP 1, Manokwari. *Jurnal Ilmu Pertanian Indonesia* 27(1): 1-6.
- Muniroh, M. S., Nusaibah, S. A., Vadmalai, G., and Siddique, Y. (2019). Proficiency of biocontrol agents as plant growth promoters and hydrolytic

- enzyme producers in *Ganoderma boninense* infected oil palm seedlings. *Current Plant Biology* 20, 100116.
- Ningtias, W., Mugiaستuti, E., Rahayuniati, R. F., dan Soesanto, L. (2020). Penggunaan formula cair *Trichoderma harzianum* T10 berbahan tepung jagung terhadap rebah semai (*Pythium* sp.) bibit mentimun. *Jurnal Agronida* 6(2): 73-82
- Nugraheni, E. S. (2010). Karakterisasi biologi isolat-isolat *Fusarium* sp pada tanaman cabai merah (*Capsicum annum* l.) asal boyolali. [Skripsi]. UNS (Universitas Sebelas Maret).
- Nugroho, L.H., Verberne, M.C., Verpoorte, R., (2002). Activities of enzymes involved in the phenylpropanoid pathway in constitutively salicylic acid-producing tobacco plants. *Plant Physiol. Biochem* 40: 755–760.
- Nurbailis., Ulqoriah, A. R., and Martinus. (2020). Various applications of active materials *Trichoderma* sp. rc 3 isolate for antracnosa disease control caused by *Colletotrichum gloeosporioides* in chilli. *The Journal of Food and Medicinal Plants* 1(1): 20-26.
- Nurbailis., Mardinus., Nasir, N., Dharma, A., and Habazar, T. (2016). The chitinase activity in banana seedling that induce by *Trichoderma* spp as resistance response to *Fusarium oxyporum* f. sp. *cubense*. *International Journal on Advanced Science, Engineering and Information Technology* 6(3): 356-360.
- Nurzannah, S. E., Lisnawita, L., dan Bakti, D. (2014). Potensi jamur endofit asal cabai sebagai agens hayati untuk mengendalikan layu fusarium (*Fusarium oxysporum*) pada cabai dan interaksinya. *Jurnal Agroekoteknologi Universitas Sumatera Utara*, 2(3): 100407.
- Okungbowa, F. I., and Shittu, H. O. (2012). Fusarium wilts: An overview. *Environ. Res. J* 6(2): 83-102.
- Pattern, C.L and Glick, B.R. (2005). Isolation and characterization of indol acetic acid biosynthesis genes from PGPR. Dept. of Biology University of Waterloo, Ontario, Canada.
- Play, S. S., Tyasdjaja, A., Ermawati, Y., dan Hantoro, F. R. P. (2010). *Budidaya dan pascapanen cabai merah (Capsicum annum L.)*. BPTP Jawa Tengah.
- Pieterse, C. M., Zamioudis, C., Berendsen, R. L., Weller, D. M., Van Wees, S. C., and Bakker, P. A. (2014). Induced systemic resistance by beneficial microbes. *Annual review of phytopathology* 52: 347-375.
- Purwanto, B., Sumadi, S., Nuraini, A., And Setiawati, M. R. (2022). Effect of water content on conidia of *Trichoderma* spp., indole acetic acid content, electrical conductivity, and pH. *Biodiversitas Journal of Biological Diversity*, 23(5).
- Purwati, R. D., Hidayah, N., Sudjinro., and Sudarsono (2008). Inoculation methods and conidial densities of *Fusarium oxysporum* f. sp. *cubense* in Abaca. *Hayati Journal of Biosciences* 15(1): 1-7.
- Putri, O. S. D., Sastrahidayat, I. R., dan Djauhari, S. (2014). Pengaruh metode inokulasi jamur *Fusarium oxysporum* f. sp. *lycopersici* (sacc.) terhadap

- kejadian penyakit layu fusarium pada tanaman tomat (*Lycopersicum esculentum* Mill.). *Jurnal HPT* 2(3): 74-81.
- Ramírez-Valdespino, C. A., Casas-Flores, S., & Olmedo-Monfil, V. (2019). *Trichoderma* as a model to study effector-like molecules. *Frontiers in microbiology*, 10: 1030.
- Rex Consortium. (2016). Combining selective pressures to enhance the durability of disease resistance genes. *Frontiers in Plant Science*, 7: 1916.
- Rivera-Mendez, W., Obregon, M., Moran-Diez, M. E., Hermosa, R., and Monte, E. (2020). *Trichoderma asperellum* biocontrol activity and induction of systemic defenses against *Sclerotium cepivorum* in onion plants under tropical climate conditions. *Biological Control* 141: 1-9.
- Romanazzi, G., and Feliziani, E. (2016). Use of chitosan to control postharvest decay of temperate fruit: effectiveness and mechanisms of action. In *Chitosan in the preservation of agricultural commodities*. Academic Press: 155-177.
- Samuels, G.J., Lieckfeldt, E., and Nirenberg, H.I. (1999). *Trichoderma asperellum*, a new species with warted conidia, and redescription of *T. viride*. *Sydowia* 51(1): 71–88.
- Saravanan, T., Bhaskaran, R., and Muthusamy, M. (2004). *Pseudomonas fluorescens* induced enzymological changes in banana roots (cv. Rasthali) against Fusarium wilt disease. *Plant Pathology Journal* 3(2): 72-80
- Sasaki, K., Iwai, T., Hiraga, S., Kuroda, K., Seo, S., Mitsuhashi, I., ... and Ohashi, Y. (2004). Ten rice peroxidases redundantly respond to multiple stresses including infection with rice blast fungus. *Plant and Cell Physiology* 45(10): 1442-1452.
- Scott-Craig, J. S., Kerby, K. B., Stein, B. D., and Somerville, S. C. (1995). Expression of an extracellular peroxidase that is induced in barley (*Hordeum vulgare*) by the powdery mildew pathogen (*Erysiphe graminis* f. sp. *hordei*). *Physiological and Molecular Plant Pathology* 47(6): 407-418.
- Sebumpan, R., Guiritan, K. R., Suan, M., Abapo, C. J., Bhat, A. H., Machado, R. A., ... and Sumaya, N. H. (2022). Morphological and molecular identification of *Trichoderma asperellum* isolated from a dragon fruit farm in the southern Philippines and its pathogenicity against the larvae of the super worm, *Zophobas morio* (Fabricius, 1776) (Coleoptera: Tenebrionidae). *Egyptian Journal of Biological Pest Control* 32(1): 1-7.
- Sehim, A. E., Hewedy, O. A., Altammar, K. A., Alhumaidi, M. S., and Abd Elghaffar, R. Y. (2023). *Trichoderma asperellum* empowers tomato plants and suppresses *Fusarium oxysporum* through priming responses. *Frontiers in Microbiology* 14: 1140378.
- Semangun. 1989. Penyakit - penyakit tanaman hortikultura di Indonesia. Yogyakarta. Gadjah Mada University Press.
- Semangun, 2000. *Pengantar Ilmu Penyakit Tumbuhan*. Yogyakarta. Gajah Mada University Press.

- Shoresh, M., Yedidia, I., and Chet, I. (2005). Involvement of jasmonic acid/ethylene signaling pathway in the systemic resistance induced in cucumber by *Trichoderma asperellum* T203. *Phytopathology* 95(1): 76-84.
- Siahaan, S. H., Goklas, Y. A. O., dan Siahaan, F. (2022). Penyuluhan pengolahan cabai merah (*Capsicum annum*) menjadi sari cabai original untuk menciptakan peluang usaha bagi masyarakat Desa Siboruon Kecamatan Balige Kabupaten Toba Samosir. *Indonesian Journal Of Community Service* 2(2):106-115.
- Simko I, and Piepho H P. (2012). The area under the disease progress stairs: calculation, advantage, and application. *Phytopathology*, 102(4): 381-389.
- Sopialena. (2018). *Pengendalian hayati dengan memberdayakan potensi mikroba*. Mulawarman University Press.
- Stracquadanio, C., Quiles, J. M., Meca, G., and Cacciola, S. O. (2020). Antifungal activity of bioactive metabolites produced by *Trichoderma asperellum* and *Trichoderma atroviride* in liquid medium. *Journal of Fungi* 6(4): 263.
- Sumarni, N., dan Muhamar, A. (2005). *Budidaya tanaman cabai merah*. Balai Penelitian Tanaman Sayuran.
- Sundar, A. R., Viswanathan, R., Malathi, P., and Padmanaban, P. (2006). Mechanism of resistance induced by plant activators against *Colletotrichum falcatum* in sugarcane. *Archives of Phytopathology and Plant Protection* 39(4): 259-272.
- Susanna, S., Alfizar, A., dan Fitriadi, E. (2023). Efektivitas dosis dan waktu aplikasi pupuk kompos trico-glio untuk pengendalian penyakit layu fusarium (*Fusarium* sp.) pada tanaman cabai merah (*Capsicum annum* L.). *Agrikultura* 34(3): 435-444.
- Suswati, S., Indrawaty, A., dan Friardi, F. (2015). Aktivitas enzim peroksidase pisang kepok dengan aplikasi glomus tipe 1. *Jurnal Hama dan Penyakit Tumbuhan Tropika*, 15(2): 141-151.
- Vallad, G. E., and Goodman, R. M. (2004). Systemic acquired resistance and induced systemic resistance in conventional agriculture. *Crop science* 44(6): 1920-1934.
- Verma, R., Dutta, A., Choudhary, A. K., and Maurya, S. (2017). *Trichoderma asperellum*, a potential fungal biocontrol agent against *Aspergillus niger*. *Journal of Advanced Laboratory Research in Biology* 8(4): 74-78.
- Vogt, T. (2010). Phenylpropanoid biosynthesis. *Molecular plant* 3(1): 2-20.
- Walter, S., Nicholson, P., and Doohan, F. M. (2010). Action and reaction of host and pathogen during Fusarium head blight disease. *New Phytologist* 185(1): 54-66.
- Wang, J. E., Liu, K. K., Li, D. W., Zhang, Y. L., Zhao, Q., He, Y. M., and Gong, Z. H. (2013). A novel peroxidase *CanPOD* gene of pepper is involved in defense responses to *Phytophthora capsici* infection as well as abiotic stress tolerance. *International Journal of Molecular Sciences* 14(2): 3158-3177.

- Wardhana, V. W., Wiyono, S., Hidayat, S. H., dan Widodo, W. (2021). Patogenisitas *Fusarium oxysporum* endofit asal gulma dari pertanaman pisang terhadap bibit pisang raja bulu. *Jurnal Fitopatologi Indonesia* 17(1): 1-8.
- Watanabe, T. (2002). *Pictorial atlas of soil and seed fungi morphologies of cultured fungi and key to species*. Second Edition. CRC Press LLC: USA.
- Woo, S. L., Hermosa, R., Lorito, M., and Monte, E. (2023). *Trichoderma*: a multipurpose, plant-beneficial microorganism for eco-sustainable agriculture. *Nature Reviews Microbiology*, 21(5): 312-326.
- Yao, X., Guo, H., Zhang, K., Zhao, M., Ruan, J., and Chen, J. (2023). *Trichoderma* and its role in biological control of plant fungal and nematode disease. *Frontiers in microbiology* 14: 1160551.
- Zehra, A., Meena, M., Dubey, M. K., Aamir, M., and Upadhyay, R. S. (2017). Activation of defense response in tomato against *Fusarium* wilt disease triggered by *Trichoderma harzianum* supplemented with exogenous chemical inducers (SA and MeJA). *Brazilian Journal of Botany* 40: 651-664.

