

DAFTAR PUSTAKA

- Agrios, G.N. 2005. *Plant Pathology, Fifth Edition*. Elsevier Academic Press, New York.
- Ali, M.A. 2002. *Biological Variation and Chemical Control of *Rhizoctonia solani* Causing Rice Sheath Blight in Bangladesh*. Department of Biological Sciences, Imperial College for Science, Technology and Medicine. Silwood Park, Ascot, Berkshire. 202p.
- Ando, H., Kurata, A. & Kishimoto, N. 2015. Antimicrobial properties and mechanism of volatile isoamyl acetate, a main flavour component of Japanese sake (Ginjo-shu). *Journal of Applied Microbiology*. 118: 873-880. Doi: 10.1111/jam.12764.
- Anonim. 2017. Manfaat *Trichoderma* sp. dan Cara Pemiakkannya. <https://disbun.kaltimprov.go.id/artikel/manfaat-trichoderma-sp-cara-pemiakkannya>. Diakses 13 Desember 2020.
- Anonim. 2020. Luas panen, produksi, dan produktivitas padi menurut provinsi. <https://www.bps.go.id/indicator/53/1498/1/luas-panen-produksi-dan-produktivitas-padi-menurut-provinsi.html>. Diakses 11 November 2020.
- Bahuguna, R.N., Joshi, R., Shukla, A., Pandey, M., & Kumar, J. 2012. Thiamine primed defense provides reliable alternative to systemic fungicide carbendazim against sheath blight disease in rice (*Oryza sativa* L.). *Plant Physiology Biochemistry*. 57:159–167.
- Banerjee, S., Datta, S., Mondal, A., & Bhattacharya, S. 2012. Characterization of molecular variability in *Rhizoctonia solani* isolate from different agroecological zone by random amplified polymorphic DNA (RAPD) markers. *African Journal of Biotechnology*. 11(40): 9543-9548.
- Banniza, S., Sy, A.A., Bridge, P.D., Simons, S.A., & Holderness, M. 1999. Characterization of populations of *Rhizoctonia solani* in paddy rice fields in Cote d' Ivoire. *Phytopathology*. 89: 414-420.
- Bernardes-de-Assis, J., Storari, M., Zala, M., Jiang, D., ShiDong, L., Jin, M., McDonald, B.A. & Ceresini, P.C. 2009. Genetic structure of populations of the rice-infecting pathogen *Rhizoctonia solani* AG1- IA from China. *Phytopathology*. 99: 1090-1099.
- Bigot, G., Sivilotti, P., Stecchina, M., Lujan, C., Freccero, A., Mosetti, D. 2020. Long-term effects of *Trichoderma asperellum* and *Trichoderma gamsii* on the prevention of esca in different vineyards of Northeastern Italy. *Crop Protection*. 137: 1–5. Doi: [10.1016/j.cropro.2020.105264](https://doi.org/10.1016/j.cropro.2020.105264).
- Boat, M.A.B., Sameza, M.L., Iacomì, B., Tchameni, S.N. & Boyom, F.F. 2020. Screening, identification and evaluation of *Trichoderma* spp. for biocontrol potential of common bean damping-off pathogens. *Biocontrol Science and Technology*. 30(3): 228-242. Doi: [10.1080/09583157.2019.1700909](https://doi.org/10.1080/09583157.2019.1700909).
- Brotman Y, Lisec J, Meret M ´ et al. 2012. Transcript and metabolite analysis of the *Trichoderma*-induced systemic resistance response to *Pseudomonas syringae* in *Arabidopsis thaliana*. *Microbiology*. 158: 139–46.
- Bruehl, G.W. 1987. *Soilborne Plant Pathogen*. Macmilan Publishin Co., New York.

- Butranu, W. 1988. Carrying capacity of component crops on *Rhizoctonia solani* Kuhn inoculum in relation to multiple cropping. *Master's Thesis*. University of the Philippines Los Baños, Los Baños, Philippines.
- Calvo, A.M., Wilson, R.A., Bok, J.W. & Keller, N.P. 2002. Relationship between secondary metabolism and fungal development. *Microbiology and Molecular Biology Reviews*. 66: 447-459.
- Carling, D.E., Baird, R.E., Gitaitis, R.D., Brainard, K.A., & S. Kuninaga. 2002. Characterization of AG-13, a newly reported anastomosis group of *Rhizoctonia solani*. *Phytopathology*. 92:893–899.
- Chamzurni, T., Oktarina, H., & Hanum, K. 2013. Keefektifan *Trichoderma harzianum* dan *Trichoderma virens* untuk mengendalikan *Rhizoctonia solani* Kühn pada Bibit Cabai (*Capsicum annum* L.). *Jurnal Agrista*. 17(1): 12-17.
- Chakrapani, K., Sinha, B., Chanu, T.W., Chakma, T., & Siram, T. 2019. *In vitro* evaluation of antagonistic potential of native *Trichoderma spp.* against *Rhizoctonia solani* causing sheath blight of rice in Manipur. *International Journal of Chemical Studies*. 7(1): 2207-2210.
- Charoenrak, P., Chamswang, C. 2016. Efficacies of wettable pellet and fresh culture of *Trichoderma asperellum* biocontrol products in growth promoting and reducing dirty panicles of rice. *Agriculture and Natural Resources*. 50, 243–249. Doi: [10.1016/j.anres.2016.04.001](https://doi.org/10.1016/j.anres.2016.04.001).
- Chen, L.-H., Zhang, J., Shao, X.-H., Wang, S.-S., Miao, Q.-S., Mao, X.-Y, Zai, Y.-M., She, D.-L. 2015. Development and evaluation of *Trichoderma asperellum* preparation for control of sheath blight of rice (*Oryza sativa* L.). *Biocontrol Science and Technology*. 25 (3): 316–328. Doi: [10.1080/09583157.2014.977225](https://doi.org/10.1080/09583157.2014.977225).
- Cherkupally, R., Amballa, H., & Reddy, B.N. 2017. In vitro screening for enzymatic activity of *Trichoderma* species for biocontrol potential. *Annals of Plant Sciences*. 6(11): 1784-1789.
- Chinnaswami, K., Mishra, D., Miriyala, A., Vellaichamy, P., Kurubar, B., Gompa, J., Madamsetty, S.P., & Raman, M.S. 2021. Native isolates of *Trichoderma* as biosuppressants against sheath blight and stem rot pathogens of rice. *Egyptian Journal of Biological Pest Control*. 31(12): 1-10.
- Chitarra, G.S., Abee, T., Rombouts, F.M., Posthumus, M.A. & Dijksterhuis, J. 2004. Germination of *Penicillium paneum* conidia is regulated by 1-octen-3-ol, a volatile self-inhibitor. *Applied and Environmental Microbiology*. 70: 2823-2829.
- Chitarra, G.S., Abee, T., Rombouts, F.M. & Dijksterhuis, J. 2005. 1- Octen-3-ol inhibits conidia germination of *Penicillium paneum* despite of mild effects on membrane permeability, respiration, intracellular pH and changes the protein composition. *FEMS Microbiology Ecology*. 54: 67-75.
- Choi, Y-W., Hyde, K.D., & Ho, W.W.H. 1999. Single spore isolation of fungi. *Fungal Diversity*. 3: 29-38.
- Choudary, K.A., Reddy, K.R.N. & Reddy, M.S. 2007. Antifungal activity and genetic variability of *Trichoderma harzianum* isolates. *Journal of Mycology and Plant Pathology*. 37(2): 295-300.

- Chaudhary, S., Sagar, S., Lal, M., Tomar, A., Kumar, V., Kumar, M., 2020. Biocontrol and growth enhancement potential of *Trichoderma* spp. against *Rhizoctonia solani* causing sheath blight disease in rice. *Journal of Environmental Biology*. 41: 1034–1045.
- Claydon, N., Allan, M., Hanson, J.R. & Avent, A.G. 1987. Antifungal alkyl pyrones of *Trichoderma harzianum*. *Transactions of the British Mycological Society*. 88: 503-513.
- Combet, E., Henderson, J., Eastwood, D.C. & Burton, K.S. 2006. Eight-carbon volatiles in fungi: properties, analysis, and biosynthesis. *Mycoscience*. 47: 317-326.
- Cook, R. & Baker, K.F. 1983. *The Nature and Practice of Biological Control of Plant Pathogens*. American Phytopathological Society, Saint Paul Minnesota.
- de França, S.K.S., Cardoso, A.F., Lustosa, D.C., Ramos, E.M.L.S., de Filippi, M.C.C., & da Silva, G.B. 2015. Biocontrol of sheath blight by *Trichoderma asperellum* in tropical lowland rice. *Agronomy for Sustainable Development*. 35, 317–324. Doi: [10.1007/s13593-014-0244-3](https://doi.org/10.1007/s13593-014-0244-3).
- Dennis, C. and Webster, J. 1971. Antagonistic properties of species groups of *Trichoderma*-II. Production of volatile antibiotics. *Transactions of the British Mycological Society*. 57: 47–48.
- Devi, K.S., Sobita, Devi, P.S., Sinha, B., Singh, L.N.K., Chanu, W.T., Maibam, N. & Devi, H.C. 2019. Effects of bio priming of rice seeds with native *Trichoderma* spp. isolated from rice rhizospheric soil. *Journal of Pharmacognosy and Phytochemistry*. 8(4): 1968-1971.
- Doni, F., Isahak, A., Zain, M.C., & Yusoff, W.M.W. 2014. Physiological and growth response of rice plants (*Oryza sativa* L.) to *Trichoderma* spp. inoculants. *AMB Express*. 4(45): 1-7.
- Doyle, J.J. & Doyle, J.L. 1990. Isolation of plant DNA from fresh tissue. *Focus*. 12: 13–15.
- Druzhinina, I.S., Komon-Zelazowska, M., Kredics, L., Hatvani, L., Antal, Z., Belayneh, T., & Kubicek, C.P., 2008. Alternative reproductive strategies of *Hypocrea orientalis* and genetically close but clonal *Trichoderma longibrachiatum*, both capable of causing invasive mycoses of humans. *Microbiology*. 154: 3447-3459.
- Dubey, S.C., Tripathi, A., Dureja, P., & Grover, A. 2011. Characterization of secondary metabolites and enzymes produced by *Trichoderma* species and their efficacy against plant pathogenic fungi. *Indian Journal of Agricultural Sciences*. 81(5): 455-461.
- El-Hassan, S.A., Gowen, S.R. & Pembroke, B. 2013. Use of *Trichoderma hamatum* for biocontrol of Lentil vascular wilt disease: efficacy, mechanisms of interaction and future prospects. *Journal of Plant Protection Research*. 53(1): 12-26.
- Gajera, H.P. & Vakharia, D.N., 2010. Molecular and biochemical characterization of *Trichoderma* isolates inhibiting a phytopathogenic fungi *Aspergillus niger* Van Tieghem. *Physiological and Molecular Plant Pathology*. 74: 274-282.
- Gangopadhyay, S. & Chakrabarti, N.K. 1982. Sheath blight on rice. *Review Plant Pathology*. 61: 451-460.

- Ghazanfar, M.U., Raza, M., Raza, W., & Qamar, M.I. 2018. *Trichoderma* as potential biocontrol agents, its exploitation in agriculture: A review. *Plant Protection*. 2(3): 109-135.
- Gnanamanickam, S.S. 2009. *Biological Control of Rice Diseases, Progress in Biological Control 8*. Springer Science and Business Media, Dordrecht, The Netherlands.
- Go, W.Z., H'ng, P.S., Wong, M.Y., Chin, K.L., Ujang, S. & Noran, A.S. 2019. Evaluation of *Trichoderma asperellum* as a potential biocontrol agent against *Rigidoporus microporus* Hevea brasiliensis. *Archives of Phytopathology and Plant Protection*. 52 (7-8) 639-666.
- Goswami, S.K., Singh, V., Kashyap, P.L., & Singh, P.K. 2019. Morphological characterization and screening for sheath blight resistance using Indian isolates of *Rhizoctonia solani* AG1IA. *Indian Phytopathology*. 72: 107-124.
- Groth, D.E., & Nowick, E.M. 1992. Selection for resistance to rice sheath blight through number of infection cushions and lesion type. *Plant Disease*. 76:721-723.
- Guleria, S., Anggarwal, R., Thind, T. & Sharma, T. 2007. Morphological and Pathological Variability in Rice Isolates of *Rhizoctonia solani* and Molecular Analysis of their Genetic Variability. *Journal of Phytopathology*. 155(11-12): 654-661.
- Guo, Q., Kamio, A., Sharma, B.S., Sagara, Y., Arakawa, M. & Inagaki, K. 2006. Survival and subsequent of rice sclerotial diseases fungi, *Rhizoctonia oryzae* and *Rhizoctonia oryzaesativae*, in paddy fields. *Plant Disease*. 90: 615-622.
- Gusnawaty, H.S., Taufik, M., Triana, L. & Asniah. 2014. Karakterisasi morfologis *Trichoderma* spp. indigenus Sulawesi Tenggara. *Agroteknos*. 4(2): 87-93.
- Hadar, Y., Modelbaum, R. & Corodecki, B. 1992. Biological Control of Soilborne Plant Pathogens by Suppressive Compost, p.79-83. In E.C. Tjamos, G.C. Papavizas, & R.J. Cook. (eds), *Biological Control of Plant Diseases*. Plenum Press, New York.
- Hajieghrari, B., Torabi-Giglou, M., Mohammadi, M.R., & Davari, M. 2008. Biological potential of some Iranian *Trichoderma* isolates in the control of soil borne plant pathogenic fungi. *African Journal of Biotechnology*. 7: 967-972.
- Harman, G.E., Howell, C.R., Viterbo, A., Chet, I., & Lorito, M. 2004. *Trichoderma* species-opportunistic, avirulent plant symbionts. *Nature Reviews Microbiology*. 2 (1): 43-56.
- Helman Zapata-Sarmiento, D., Fabiola Palacios-Pala, E., Araceli Rodríguez-Hernández, A., Laura Medina Melchor, D., Rodríguez-Monroy, M., & Sepúlveda-Jiménez, G. 2019. *Trichoderma asperellum*, a potential biological control agent of *Stemphylium vesicarium*, on onion (*Allium cepa* L.). *Biological Control*. Doi: [10.1016/j.biocontrol.2019.104105](https://doi.org/10.1016/j.biocontrol.2019.104105).
- Hiddink, G.A., Termorshuizen, A.J., Raaijmakers, J.M. & van Bruggen, A.H.C. 2005. Effect of mixed and single crops on disease suppressiveness of soils. *Phytopathology*. 95: 1325-1332.
- Hoyos-Carvajal, L. & Bissett, J. 2011. In: Grillo O, Venora G (eds) Biodiversity of *Trichoderma* in Neotropics. *INTECH Open Access Publisher*. 303.

- Inagaki, K. 2001. Outbreaks of Rice Sclerotium Diseases in Paddy Fields and Physiological and Ecological Characteristics of this Causal Fungi. *Science Replications Agricultures, Meijo University*. 37: 57-66.
- IRRI. 2013. *Standart Evaluation System (SES) for Rice*. 5th. International Rice Research Institute, Philippines.
- Jabnoun-Khiareddine, H., Daami-Remadi, M., Ayed, F. & El-Mahjoub, M. 2007. Biological control of tomato *Verticillium* wilt by using indigenous *Trichoderma* spp. *African Journal of Plant Science and Biotechnology*. 3(1): 26-36.
- Jeleń, H., Błaszczuk, L., Chelkowski, J., Rogowicz, K. & Strakowska, J. 2014. Formation of 6-n-pentyl-2h-pyran-2-one (6-pap) and other volatiles by different *Trichoderma* species. *Mycological Progress*. 13(3): 589-600.
- Jia, Y., Correa-Victoria, F., McClung, A., Zhu, L., Liu, G., Wamishe, Y., Xie, J., Marchetti, M.A., Pinson, S.R.M., Rutger, J.N. & Correll, J.C. 2007. Rapid determination of rice cultivar responses to the sheath blight pathogen *Rhizoctonia solani* using microchamber screening method. *Plant Disease*. 91: 485-489.
- Jiang, H., Zhang, L., Zhang, J-Z., Ojaghian, M.R., Hyde, K.D. 2016. Antagonistic interaction between *Trichoderma asperellum* and *Phytophthora capsici* in vitro. *Journal of Zhejiang University Science B*. 17(4):271–281.
- Jones, D.G. 1998. *The Epidemiology of Plant Diseases*. Kluwer Academic Publishers, Dordrecht, the Netherlands. 66p.
- Kamala, Th. & Indira, S. 2014. Molecular characterization of *Trichoderma harzianum* strains from Manipur and their biocontrol potential against *Pythium ultimum*. *International Journal of Current Microbiology and Applied Sciences*. 3(7): 258-270.
- Kammerer, S.J., Burpee, L.L., & Harmon, P.F. 2011. Identification of a new *Waitea circinata* variety causing basal leaf blight of seashore paspalum. *Plant Disease*. 95: 515-522.
- Keijer, J., Houterman, P.M., Dulleman, A.M., & Korsman, M.G. 1996. Heterogeneity in electrophoretic karyotype within and between anastomosis groups of *Rhizoctonia solani*. *Mycological Research*. 100: 789-797.
- Khaeruni, A., Najamuddin, E., Wijayanto, T. & Syair. 2016. Ketahanan Berbagai Padi Lokal terhadap Penyakit Hawar Daun Bakteri. *Jurnal Fitopatologi Indonesia*. 12(3): 89-95.
- Khalili, E., Sadravi, M., Naeimi, S., Khosravi, V. 2012. Biological control of rice brown spot with native isolates of three *Trichoderma* species. *Brazilian Journal of Microbiology*. 43 (1), 297–305. Doi: [10.1590/s1517-83822012000100035](https://doi.org/10.1590/s1517-83822012000100035).
- Khan, A.A., & Sinha, A.P. 2007. Screening of *Trichoderma* spp. against *Rhizoctonia solani* the causal agent of rice sheath blight. *Indian Phytopathology*. 60(4): 450–456.
- King, B.C., Waxman, K.D., Nenni, N.V., Walker, L.P., Bergstrom, G.C. & Gibson, D.M. 2011. Arsenal of plant cell wall degrading enzymes reflects host preference among plant pathogenic fungi. *Biotechnology for Biofuels*. 4(4).
- Kubicek, C.P., Mach, R.L., Peterbauer, C.K., Lorito, M. 2001. *Trichoderma*: from Genes to Biocontrol. *Journal of Plant Pathology*. 83: 11-23.

- Kumar, P.R.B., Reddy, K.R.N. & Rao, K.S. 2009. Sheath blight disease of *Oryza sativa* and its management by biocontrol and chemical control in-vitro. *Electronic Journal of Enviromental, agricultural and food Chemistry*. 8: 639-646.
- Kumar, P., Ahlawat, S., Chauhan, R., Kumar, A., Singh, R., & Kumar, A. 2018. In vitro and field efficacy of fungicides against sheath blight of rice and post-harvest fungicide residue in soil, husk, and brown rice using gas chromatography-tandem mass spectrometry. *Environmental Monitoring and Assessment*. 190(9): 1-9.
- Lanoiselet, V.M., Cother, E.J., & Ash, G.J. 2007. Aggregate sheath spot and sheath spot of rice. *Crop Protection*. 26: 799-808.
- Lee, S., Yap, M., Behringer, G., Hung, R., & Bennett, J.W. 2016. Volatile organic compounds emitted by *Trichoderma* species mediate plant growth. *Fungal Biology and Biotechnology*. 3(7). Doi: 10.1186/s40694-016-0025-7.
- Leiner, R.H. & Carling, D.E. 1994. Characterization of *Waitea circinata* (*Rhizoctonia*) isolated from agricultural soils in Alaska. *Plant Disease*. 78: 385-388.
- Leylaie, S. & Zafari, D. 2018. Antiproliferative and Antimicrobial Activities of Secondary Metabolites and Phylogenetic Study of Endophytic *Trichoderma* Species from Vinca Plants. *Frontiers in Microbiology*. 9(1484): 1-18.
- Li R-X, Cai F, Pang G, Shen Q-R, Li R, & Chen W. 2015. Solubilisation of Phosphate and Micronutrients by *Trichoderma harzianum* and Its Relationship with the Promotion of Tomato Plant Growth. *PLoS ONE*. 10(6): 0130081. <https://doi.org/10.1371/journal.pone.0130081>.
- Mahantesh, Singh, O., Vishwanath and Singh, D. 2018. Efficacy of fungicides for the management of Sheath Blight of rice. *Chemical Science Review and Letters*. 7(27): 714-718.
- Manjunatha, O., Vidya Sagar, B., Prakasam, V. & Narendra Reddy, C.N. 2018. Variability Studies on Sheath Blight of Rice in Karnataka, India. *International Journal of Current Microbiology and Applied Sciences*. 7(10): 724-736.
- Marques, E., Martins, I & de Mello, S.C.M. 2018. Antifungal potential of crude extracts of *Trichoderma* spp. *Biota Neotrop*. 18(1): 1-5.
- Marshall, D.S., & Rush, M.C. 1980. Infection cushion formation on rice sheaths by *Rhizoctonia solani*. *Phytopathology*. 70: 947-950.
- Mayo-Prieto, S., Campelo, M.P., Lorenzana, A., Rodríguez-González, A., Reinoso, B., Gutiérrez, S., Casquero, P. A. Antifungal activity and bean growth promotion of *Trichoderma* strains isolated from seed vs soil. *Europa Journal of Plant Pathology*. 158: 817–828. Doi: [10.1007/s10658-020-02069-8](https://doi.org/10.1007/s10658-020-02069-8).
- Medina-Romero, Y.M., Roque-Flores, G., & Macías-Rubalcava, M.L. 2017. Volatile organic compounds from endophytic fungi as innovative postharvest control of *Fusarium oxysporum* in cherry tomato fruits. *Applied Microbiology and Biotechnology*. 101: 8209–8222.
- Meena, M., Swapnil, P., Zehra, A., Dubey, M.K. & Upadhyay, R.S. 2017. Antagonistic assessment of *Trichoderma* spp. by producing volatile and non-volatile compounds against different fungal pathogens. *Archives of Phytopathology and Plant*. 1-20.

- Mew, T.W. & Rosales, A.M. 1992. Control of *Rhizoctonia* Sheath Blight and Other Disease of Rice by Seed Bacterization, 113–123p. In Tjamos, E.C., Papavizas, G.C. & Cook, R.J. (eds.), *Biological Control of Plant Diseases*. Plenum Press, New York.
- Miller, T.G. & Webster, R.K. 2001. Soil Sampling Techniques for Determining the Effect of Culture Practices on *Rhizoctonia oryzae-sativae* Inoculum in Rice Field Soil. *Plant Disease*. 85: 967-972.
- Mishra, P.K., Gogoi, R., Singh, P.K., Rai, S.N., Gingode, A., Kumar, A., & Manjunathan, C. 2014. Morpho-cultural and pathogenic variability in *Rhizoctonia solani* isolates from rice, maize and green gram. *Indian Phytopathology*. 67(2):147–154.
- Moni, Z.R., Ali, M.A., Alam, M.S., Rahman, M.A., Bhuiyan, M.R., Mian, M.S., Iftakharuddaula, K.M., Latif, M.A., & Khan, M.A. 2016. Morphological and Genetical Variability among *Rhizoctonia solani* Isolates Causing Sheath Blight Disease of Rice. *Rice Science*. 23(1): 42-50.
- Muhsin, R., Rosmin & Panggeso, J. 2013. Uji antagonisme *Trichoderma* sp. terhadap jamur patogen *Alternaria porri* penyebab penyakit bercak ungu pada bawang merah secara *in-vitro*. *Jurnal Agrotekbis*. 1(2): 140-144.
- Naeimi, S., Okhovvat, S.M., Javan-Nikkhah, M., Vagvolgyi, C., Khosravi, V., & Kredics, L. 2010. Biological control of *Rhizoctonia solani* AG1-1A, the causal agent of rice sheath blight with *Trichoderma* strains. *Phytopathologia Mediterranea*. 49: 287-300.
- Naeimi, S., Khosravi, V., Nouri, M-Z, Hoda, H., Vágvölgyi, C., & Kredics, L. 2019. Biological control of rice sheath blight disease with formulation of indigenous *Trichoderma* strains under paddy field conditions. *Acta Biologica Szegediensis*. 63(1): 37-43.
- Naito, S. 2004. *Rhizoctonia* diseases: Taxonomy and population biology. Proceeding of the International Seminar on Biological Control of Soilborne Plant Diseases, Japan Argentina Joint Study, Buenos Aires, Argentina. 18-31.
- Nuryanto, B. 2011. Varietas, kompos, dan cara pengairan sebagai komponen pengendali penyakit hawar upih. *Disertasi*. Program Pasca Sarjana, Universitas Gadjah Mada. Yogyakarta.
- Okull, D.O., Beelman, R.B. & Gourama, H. 2003. Antifungal activity of 10-oxo-trans-8-decenoic acid and 1-octen-3-ol against *Penicillium expansum* in potato dextrose agar medium. *Journal of Food Protection*. 66: 1503-1505. Doi: 10.4315/0362-028X-66.8.1503.
- Padasht-Dehkaei, F., Ceresini, P.C., Zala, M., Okhovvat, S.M., Nikkhah, M.J. & McDonald, B.A. 2013. Population genetic evidence that basidiospores play an important role in the disease cycle of rice-infecting populations of *Rhizoctonia solani* AG-1 IA in Iran. *Plant Pathology*. 62: 49-58.
- Palupi, T., Ilyas, S., Machmud, M., & Widajati, E. 2014. Efikasi Coating Benih dengan Agen Hayati terhadap Intensitas Penyakit Hawar Daun Bakteri, Pertumbuhan Tanaman dan Hasil Padi di Rumah Kaca. *Agripura*. 8(1): 1061 – 1067.

- Pandian, R.T.P., Raja, M., Kumar, A. & Sharma P. 2016. Morphological and molecular characterization of *Trichoderma asperellum* strain Ta13. *Indian Phytopathology*. 69: 303.
- Parmeter, J.R. & Whitney, H.S. 1970. Taxonomy and nomenclature of the imperfect state. In: Parmeter J R. *Rhizoctonia solani*: Biology and Pathology. University of California Press, Berkely. 7-19p.
- Pralhad, S.P., Krishnaraj, P.U., & Prashanthi, S.K. 2019. Morphological and Molecular Characterization of *Rhizoctonia solani* causing Sheath Blight in Rice. *International Journal of Current Microbiology and Applied Sciences*. 8(01): 1714-1721.
- Prasad, N., Singh, N., Avinash, P. & Tiwari, P.K. 2020. Efficacy of new fungicides against sheath blight disease management of rice caused by *Rhizoctonia solani* under field condition. *International Journal of Chemical Studies*. 8(3): 216-220.
- Prasad, V., Dixit, S., Giri, S.P. & Singh, D.P. 2019. Evaluation of new chemical moleculer against sheath blight of rice. *International of chemical studies*. 7(3): 4230-4232.
- Priyatmojo, A., Escopalao, V.E., Tangonan, N.G., Pascual, C.B., Suga, H., Kageyama, K., & Hyakumachi, M. 2001. Characterization of a New Subgroup of *Rhizoctonia solani* Anastomosis Group 1 (AG-1-ID), Causal Agent of a Necrotic Leaf Spot on Coffee. *The American Phytopathological Society*. 91(11): 1054-1060.
- Rabindran, R. & Vidhyasekaran, P. 1996. Development of a formulation of *Pseudomonas fluorescens* PfALR2 for management of rice sheath blight. *Crop Protection*. 15: 715–721. DOI: [10.1016/s0261-2194\(96\)00045-2](https://doi.org/10.1016/s0261-2194(96)00045-2).
- Rahayu, A.G., Haryani, Y., Puspita, F. 2014. Uji Aktivitas Selulotik dari Tiga Isolat Bakteri *Bacillus* sp. Galur Lokal Riau. *Jurnal Online Mahasiswa Fakultas Matematika dan Ilmu Pengetahuan Alam*. 1(2): 319-327.
- Rifai, M. A. 1969. *A revision of the genus Trichoderma*. Commonwealth Mycological Institute, Britain.
- Rismanto, T.A.L. 2020. Eksplorasi dan Isolasi APH *Trichoderma* sp. <https://dpkp.iogjaprovo.go.id/baca/Eksplorasi+dan+Isolasi+APH+Trichoderm+a+sp./061120/9f7d4754f2d581ad64e42cf429739095077fef95af631f9001f0b522392205d4239>. (diakses 13 Desember 2020).
- Rosewich, U.L., Pettway, R.E., McDonald, B.A., & Kistler, H.C. 1999. High levels of gene flow and heterozygote excess characterize *Rhizoctonia solani* AG-1 IA (*Thanatephorus cucumeris*) from Texas. *Fungal Genetics and Biology*. 28:148-159.
- Sachdev, S. & Singh, R.P. 2018. Isolation, Characterisation and Screening of Native Microbial Isolates for Biocontrol of Fungal Pathogens of Tomato. *Climate Change and Environmental Sustainability*. 6(1): 46-58.
- Samuels, G.J., Dodd, S.L., Gams, W., Castlebury, L.A., & Petrini, O. 2002. *Trichoderma* species associated with the green mold epidemic of commercially grown *Agaricus bisporus*. *Mycologia*. 94: 146-170.

- Sandoval, R.F.C. & Cumangun, C.J.R. 2019. Phenotypic and Molecular Analyses of *Rhizoctonia* spp. Associated with Rice and Other Hosts. *Microorganisms*. 7(88): 1-23.
- Saravanakumar, K., Yu, C., Dou, K., Wang, M., Li, Y., Chen, J., 2016. Synergistic effect of *Trichoderma*-derived antifungal metabolites and cell wall degrading enzymes on enhanced biocontrol of *Fusarium oxysporum* f. sp. *cucumerinum*. *Biological Control*. 94: 37–46.
- Savary, S., Castilla, N. P., Elazegui, F. A., McLaren, C. G., Ynalvez, M. A. & Teng, P. S. 1995. Direct and indirect effects of nitrogen supply and disease source structure on rice sheath blight spread. *Phytopathology*. 85: 959–965.
- Savary, S., Willocquet, L., Elazegui, F.A., Castilla, N.P. & Teng, P.S. 2000. Rice pest constraints in tropical Asia: characterization of injury profiles in relation to production situations. *Plant Disease*. 84: 341-356.
- Scarselletti, R. & Faul, J.L. 1994. In vitro activity of 6-pentyl-apyrone, a metabolite of *Trichoderma harzianum* in the inhibition of *Rhizoctonia solani* and *Fusarium oxysporum* f. sp. *Lycopersici*. *Mycological Research*. 98: 1207-1209.
- Semangun, H. 2008. *Penyakit-Penyakit Tanaman Pangan di Indonesia*. Edisi kedua. UGM Press, Yogyakarta. 475 p.
- Shah, S., Nasreen, S., Sheikh, P.A. 2012. Cultural and morphological characterization of *Trichoderma* sp. associated with green mold disease of *Pleutorus* sp. in Kashmir. *Research Journal of Microbiology*. 7(2): 139-144.
- Sharma, M., Gupta, S.K. & Sharma, T.R. 2005. Characterization of variability in *Rhizoctonia solani* by using morphological and molecular markers. *Phytopathology*. 153: 449-456.
- Sherwood, R.T. 1969. Morphology and pathology in four anastomosis groups of *Thanatephorus cucumeris*. *Journal Phytopathology*. 59: 1924-1929.
- Siddiquee, S. 2017. *Practical Handbook of the Biology and Molecular Diversity of Trichoderma Species from Tropical Regions*, Fungal Biology. Springer International Publishing AG, Switzerland. 46 p.
- Singh, A. & Sharma, S. 2002. Composting of crop residue through treatment with microorganisms and subsequent vermicomposting. *Bioresource Technology*. 85: 107-111.
- Singh, B.N., Singh, A., Singh, S.P., Singh, H.B., 2011. *Trichoderma harzianum* mediated reprogramming of oxidative stress response in root apoplast of sunflower enhances defence against *Rhizoctonia solani*. *European Journal of Plant Pathology*. 131 (1): 121–134. [Doi: 10.1007/s10658-011-9792-4](https://doi.org/10.1007/s10658-011-9792-4).
- Singh, A.K. & Srivastava, J.N. 2015. *Recent Advances in the Diagnosis and Management of Plant Diseases*. Chapter 9 Sheath Blight Disease of Paddy and Their Management. 91-99p.
- Singh, V., Amaradasa, B.S., Karjagi, C.G., Lakshman, D.K., Hooda, K.S., & Kumar, A. 2018. Morphological and molecular variability among Indian isolates of *Rhizoctonia solani* causing banded leaf and sheath blight in maize. *European Journal of Plant Pathology*. 152(1): 45–60.

- Singh, P., Mazumdar, P., Harikrishna, J.A., & Babu, S. 2019. Sheath blight of rice: a review and identification of priorities for future Research. *Planta*. 250: 1387-1407.
- Sivalingan, P.N., Vishwakarma, S.N., & Singh, U.S. 2006. Role of seedborne inoculum of *Rhizoctonia solani* in sheath blight of rice. *Indian Phytopathology*. 59(4): 445-452.
- Sneh, B., Burpee, L., & Ogoshi, A. 1998. Identification of *Rhizoctonia* species. The APS, St. Paul, Minnesota.
- Soesanto, L. 2008. *Pengantar Pengendalian Hayati Penyakit Tanaman*. PT Raja Grafindo Persada, Jakarta. 573 p.
- Soesanto, L. 2015. Metabolit sekunder agensia pengendali hayati: terobosan baru pengendalian organisme pengganggu tanaman perkebunan. (On-line). <http://www.researchgate.net/profile/LoekasSoesanto/publication/278261729Terobosanbaruatasipengganguktanaman/links/557e6f5f08aec87640dc668b.pdf?disableCoverPage=true&inViewer=1>. Diakses 1 Mei 2019.
- Srinivas, P., Ratan, V., Patel, A.P., & Madhavi, G.B. 2013. Review on banded leaf and sheath blight of rice caused by *Rhizoctonia solani* Kuhn. *International Journal of Applied Biology and Pharmaceutical Technology*. 61: 80-97.
- Stracquadanio, C., Quiles, J.N., Meca, G., & Cacciola, S.O. 2020. Antifungal activity of bioactive metabolites produced by *Trichoderma asperellum* and *Trichoderma atroviride* in liquid medium. *Journal of Fungi*. 6 (263): 1-18.
- Sudantha, I. M. 2009. Karakterisasi jamur saprofit dan potensinya untuk Pengendalian Jamur *Fusarium oxysporum* f. sp. *vanilla* pada tanaman vanili. *Agroteksos*. 19(3): 89-100.
- Sudir, Nasution, A., Santoso & Nuryanto, B. 2014. Penyakit Blas *Pyricularia grisea* pada Tanaman Padi dan Strategi Pengendaliannya. *IPTEK Tanaman Pangan*. 9(2): 85-96.
- Suparyono & Sudir. 1999. Peran Sklerosia dan Bentuk Lain Pathogen *Rhizoctonia solani* Kuhn, sebagai Sumber Inokulum Awal Penyakit Hawar Pelepah Padi. *Jurnal Perlindungan Tanaman Indonesia*. 5: 7-12.
- Suprihatno, B., Daradjat, A.A., Satoto, Baehaki, S.E., Widiarta, N., Setyono, A., Indrasari, S.D., Lesmana, O.S. & Sembiring, H. 2007. Deskripsi varietas padi. Balai Besar Penelitian Tanaman Padi, Sukamandi. 80p.
- Susheela, K. & Reddy, C.S. 2013. Variability in *Rhizoctonia solani* (AG11A) isolates causing sheath blight of rice in India. *Indian Phytopathology*. 66(4):341-350.
- Suwarno. 2010. Meningkatkan Produksi Padi menuju Ketahanan Pangan yang Lestari. *Pangan*. 19(3): 233-243.
- Syahputra, H.M., Anhar, A. & Irdawati. 2017. Isolasi *Trichoderma* spp. dari beberapa Rizosfer Tanaman Padi Asal Solok. *Journal Biosains*. 1(2): 97-105.
- Tabarestani, M.S., Rahnama, K., Jahanshahi, M., Nasrollanejad, S., & Fatemi, M.H. 2016. Identification of Volatile Organic Compounds from *Trichoderma virens* (6011) by GC-MS and Separation of a Bioactive Compound via Nanotechnology. *International Journal of Engineering (IJE), TRANSACTIONS A: Basics*. 29(10): 1347-1353.

- Taheri, P., Gnanamanickam, S., & Hofte, M. 2007. Characterization, genetic structure, and pathogenicity of *Rhizoctonia* spp. associated with rice sheath diseases in India. *Phytopathology*. 97: 373-83.
- Taheri, P., & Tarighi, S. 2010. Riboflavin induces resistance in rice against *Rhizoctonia solani* via jasmonate-mediated priming of phenylpropanoid pathway. *Journal of Plant Physiology*. 167: 201–208.
- Talbot, N.J. 2010. Living the sweet life: How does a plant pathogenic fungus acquire sugar from plants? *PLoS Biology*. 8(2).
- Tamura, K., Peterson, D., Peterson, N., Stecher, G., Nei, M., and Kumar, S. 2011. MEGA5: Molecular Evolutionary Genetics Analysis Using Maximum Likelihood, Evolutionary Distance, and Maximum Parsimony Methods. *Molecular Biology and Evolution*. 28(10): 2731–2739.
- Taribuka, J. 2016. Peranan *Trichoderma* endofit dalam Pengendalian Layu Fusarium (*Fusarium Oxysporum* f.s.p. *cubense*) pada Pisang. *Disertasi*. Fakultas Pertanian UGM, Yogyakarta.
- Thakur, M. & Sohal, B.S. 2013. Role of elicitors in inducing resistance in plants against pathogen infection: a review. *ISRN Biochemistry*. 1–10. Doi:10.1155/2013/762412.
- Tuli, M., Gurumayum, S., Kaur, S., Nagal, S., Attri, I. 2015. Isolation and Screening of Cellulolytic Fungi by Baiting Method from Soils of Jalandhar. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 6(2): 375-380.
- Vinale, F., Ghisalberti, E.L., Sivasithamparam, K., Marra, M., Ritieni, A., Ferracane, R., Woo, S., & Larito, M. 2009. Factors affecting the production of *Trichoderma harzianum* secondary metabolites during the interaction with different plant pathogens. *Applied Microbiology*. 48, 705–711. [Doi: 10.1111/j.1472-765X.2009.02599.x](https://doi.org/10.1111/j.1472-765X.2009.02599.x).
- Vinale, F., Sivasithamparam, K., Ghisalberti, E. L., Woo, S. L., Nigro, M., Marra, R., Lorito, M. 2014. *Trichoderma* secondary metabolites active on plants and fungal pathogens. *The Open Mycology Journal*. 8(1): 127-139. Doi: [10.2174/1874437001408010127](https://doi.org/10.2174/1874437001408010127).
- Viterbo, A., Wiest, A., Brotman, Y., Chet, I., & Kenerley, C.M. 2007. The 18mer peptaibols from *Trichoderma virens* elicit plant defense responses. *Molecular Plant Pathology*. 8: 737-746.
- Waghunde, R.R., Shelake, R.M. & Sabalpara, A.N. 2016. *Trichoderma*: A significant fungus for agriculture and environment. *African Journal of Agricultural Research*. 11(22): 1952-1965.
- Waluyo, K.A., Soesanto, L. & Djatmiko, H.A. 2005. Keefektifan tebukonazol dan *Trichoderma harzianum* tunggal atau gabungan terhadap tiga penyakit penting karena jamur pada padi sawah. *Tropika* 13(2): 128-136.
- Wang, T., Duan, Y.J., Liu, B.T., Guo, G., Zhou, D.B., Tan, X., Zhang, X.Y. & Huang, M.J. 2011. The colonization of two strains of antagonistic bacteria of *Fusarium oxysporum* in banana. *Genomics Applied Biology*. 30(3): 342-350.
- Wang, C., Pi, L., Jiang, S., Yang, M., Shu, C. & Zhou, E. 2018. ROS and trehalose regulate sclerotial development in *Rhizoctonia solani* AG-1 IA. *Fungal Biology*. 122: 322-332.



- Wang, C., & Wen-ying, Z. 2019. Evaluating effective *Trichoderma* isolates for biocontrol of *Rhizoctonia solani* causing root rot of *Vigna unguiculata*. *Journal of Integrative Agriculture*. 18(9): 2072–2079.
- Weller, D.M., Raaijmakers, J.M., McSpadden-Gardener, N.B. & Thomashow, L.S. 2002. Microbial Population Responsible for Specific Soil Suppressiveness to Plant Pathogens. *Annual Review Phytopathology*. 40: 309-348.
- Wheatley, R., Hackett, C., Bruce, A., & Kundzewicz, A. 1997. Effect of Substrate Composition on Production of Volatile Organic Compounds from *Trichoderma* spp. Inhibitory to Wood Decay Fungi. *International Biodeterioration & Biodegradation*. 39(2-3): 199-205.
- White, T.J., Bruns, T., Lee, S. & Taylor, J. 1990. *Amplification and Direct Sequencing of Fungal Ribosomal RNA Genes for Phylogenetics*. In: Innis, M.A., Gelfand, D.H., Sninsky, J.J. and White, T.J., Eds., PCR Protocols. A Guide to Methods and Applications, Academic Press, San Diego. 315-322.
- Willets, H.J., & Bullock, S. 1992. Developmental biology of sclerotia. *Mycological Research*. 6: 801-816.
- Worasatit, N., Sivasithamparan, K., Ghisalberti, E. L., & Rowland, C. 1994. Variation in pyrone production, lytic enzymes and control of rhizoctonia root rot of wheat among single-spore isolates of *Trichoderma koningii*. *Mycological Research*. 98: 1357–1363. Doi: 10.1016/S0953-7562(09)81063-0.
- Wu, Q., Sun, R., Ni, M., Yu, J., Li, Y., Yu, C., Dou, K., Ren, J. & Chen, J. 2017. Identification of a novel fungus, *Trichoderma asperellum* GDFS1009, and comprehensive evaluation of its biocontrol efficacy. *PLoS ONE*. 12(6): 1-20.
- Xian, H., Liu, L., Li, Y., Yang, Y., Yang, S., 2019. Molecular tagging of bio-control fungus *Trichoderma asperellum* and its colonization in soil. *Journal of Applied Microbiology*. 128(1): 255-264.
- Yellareddy, S.K.R., Reddy, M.S., Kloepper, J.W., Lawrence, K.S., & Fadami, H. 2014. Rice Sheath Blight: A Review of Disease and Pathogen Management Approaches. *Journal of Plant Pathology & Microbiology*. 5(4): 1-4.
- Yunanda, A.P., Fauzi, A.R., Junaedi, A., 2013. Growth and Production of Rice IR64 and Jatiluhur Varieties on Lowland and Upland Culture Systems. *Buletin Agrohorti*. 1 (4), 18–25. Doi: [10.29244/agrob.1.4.18-25](https://doi.org/10.29244/agrob.1.4.18-25).
- Zehra, A., Dubey, M.K., Meena, M. & Updhyay, R.S. 2017. Effect of different environmental conditions on growth and sporulation of some *Trichoderma* species. *Journal of Environmental Biology*. 38: 197-203.
- Zhang, C. Q., Liu, Y. H., Ma, X. Y., Feng, Z., Ma, Z. H., 2009. Characterization of sensitivity of *Rhizoctonia solani*, causing rice sheath blight, to mepronil and boscalid. *Crop Protection*. 28 (5), 381–386. Doi: 10.1016/j.cropro.2008.12.004.