

## DAFTAR PUSTAKA

- Abdel-Nasser A, Hathout AS, Badr AN, Barakat OS, Fathy HM. 2023. Extraction and characterization of bioactive secondary metabolites from lactic acid bacteria and evaluating their antifungal and antiaflatoxigenic activity. *Biotechnology Reports*, 38, e00799. <https://doi.org/10.1016/j.btre.2023.e00799>
- Agwara IC, Oladele AA, Agbara AA. 2023. Antimicrobial effect of different seed extracts of *Piper nigrum* against *Escherichia coli*, *Staphylococcus aureus* and *Candida albicans*. *Biotechnological Research*, 1(1), 1–7.
- Ahmad MF, Rozihawati Z, Muhammad SH, Razak T, Wan AWMA, Nik IPS, Affendy H. 2022. Diversity of endophytic fungi isolated from different plant parts of *Acacia mangium*, and antagonistic activity against *Ceratocystis fimbriata*, A Casual Agent of *Ceratocystis* Wilt Disease of *A Mangium* in Malaysia. *Frontiers in Microbiology*, 13, 887880.
- Ahmad N, Fazal H, Abbasi BH, Farooq S, Ali M, Khan MA. 2012. Biological role of *Piper nigrum* L. (Black pepper): a review. *Asian Pacific Journal of Tropical Biomedicine*. 2: S1945–S1953.
- Aji, A, Bahri S, dan Tantalina. 2017. Pengaruh waktu ekstraksi dan konsentrasi HCl untuk pembuatan pektin dari kulit jeruk bali (*citrus maxima*). *Jurnal Teknologi Kimia Unimal*, vol. 6(1).
- Akbar, MI, Zaidul IS, Abdulkarim SM, dan Fazilah, A. 2014. Antioxidant capacity of *Piper longum* and *Piper nigrum* fruits grown in Bangladesh. *World Journal of Pharmaceutical Sciences*, 2(9), 931–941.
- Akin M, dan Saki N. 2019. Antimicrobial, DPPH scavenging and tyrosinase inhibitory activities of *Thymus vulgaris*, *Helichrysum arenarium* and *Rosa damascena* mill. ethanol extracts by using TLC bioautography and chemical screening methods. *Journal of Liquid Chromatography & Related Technologies*, 42(7–8), 204–216. <https://doi.org/10.1080/10826076.2019.1591977>
- Alaris DD, Ricky, J Fitriyani, Adang, Wiwin W. 2020. Peningkatan Kelarutan Ekstrak Lada (*Piper nigrum* L.) dalam Air dan Karakterisasinya. *Jurnal Sains dan Teknologi Farmasi Indonesia*, Vol. 9(1): 61-74.
- AlKahtani MD, Fouda A, Attia KA, Otaibi FAI, Eid AM, Ewais EED. 2020. Isolasi dan karakterisasi bakteri endofit pemacu pertumbuhan tanaman dari tumbuhan gurun dan aplikasinya sebagai bioinokulan untuk pertanian berkelanjutan. *Agronomi*.10(9):1325. <https://doi.org/10.3390/agronomy10091325>.
- Angeli L, Ksenia M, Matteo S. 2023. A Kinetic-based Stopped-flow DPPH• method. *Scientific Reports*, 13, 2099.
- Aristyawan A, Ulya S, Susant R. 2017. Uji aktivitas antibakteri ekstrak etanol daun belimbing wuluh (*Averrhoa bilimbi*) terhadap pertumbuhan bakteri *Streptococcus mutans*. *Jurnal Sains dan Kesehatan*, 9(1), 1–6.
- Ariyanto N. 2021. *Perencanaan pengembangan wilayah untuk kebun lada*. Politeknik Negeri Lampung.

- Arora J, Ramawat KG. 2017. An Introduction to Endophytes. *Mohanlal Sukhadia University*. <https://doi.org/10.1007/978-3-319-66541-2>
- Ashokkumar K, Murugan M, Dhanya MK, Pandian A, Warkentin TD. 2021. Phytochemistry and therapeutic potential of black pepper [*Piper nigrum* (L.)] essential oil and piperine: a review. *Clinical Phytoscience*, 7, 52. DOI: 10.1186/s40816-021-00292-2
- Baliyan S, Saini RV. 2022. Determination of antioxidant activities of berries and their products using DPPH radical scavenging assay. *Antioxidants*, 11(3), 453. <https://doi.org/10.3390/antiox11030453>
- Balouiri M, Sadiki M, Ibensouda SK. 2016. Methods for *in vitro* evaluating antimicrobial activity: A review. *Journal of Pharmaceutical Analysis*, 6(2), 71–79. <https://doi.org/10.1016/j.jpha.2015.11.005>
- Bapat VA, Kavi Kishor PB, Jalaja N, Mohan JS, Suprasanna P. 2023. Plant cell cultures: Biofactories for the Production of Bioactive Compounds. *Agronomy*, 13(3), 858. <https://doi.org/10.3390/agronomy13030858>
- Barakat MR, El-Sayed ESA, Al-Zahrani, AA. 2018. Fungal endophytes as the source of medicinal natural product. *Jurnal Ilmiah Farmasi*, 15(1), 1–7.
- BioLibreTexts. 2023. Column chromatography. *Biological Methods Encyclopedia*. [https://bio.libretexts.org/Bookshelves/Biotechnology/Encyclopedia\\_of\\_Biological\\_Methods\\_%28Mattaini%29/06%3A\\_Column\\_Chromatograph](https://bio.libretexts.org/Bookshelves/Biotechnology/Encyclopedia_of_Biological_Methods_%28Mattaini%29/06%3A_Column_Chromatograph)
- Boruta T. 2021. A bioprocess perspective on the production of secondary metabolites by *Streptomyces* in submerged co-cultures. *World Journal of Microbiology & Biotechnology*, 37(10), 171. <https://doi.org/10.1007/s11274-021-03141-z>
- Boy HIA, Rutilla AJH, Santos KA, Ty AMT, Yu AI, Mahboob T, Tangpoong J, Nissapatorn V. Recommended Medicinal Plants as Source of Natural Products: A Review. 2018. *Digital Chinese Medicine*, 1(2): 131-142. [https://doi.org/10.1016/S2589-3777\(19\)30018-7](https://doi.org/10.1016/S2589-3777(19)30018-7)
- Britannica. 2025. *Black pepper*. <https://www.britannica.com/plant/black-pepper-plant>
- Cappuccino JG, Sherman N. 2014. *Manual Laboratorium Biologi*. Jakarta: EGC.
- Carsono N, Susanto R, Kurnia D. 2022. A review of bioactive compounds and antioxidant activity properties of *Piper* species. *Molecules*, 27(19), 6774. <https://doi.org/10.3390/molecules27196774>
- Charles DJ. 2013. *Antioxidant properties of spices, herbs and other sources*. In *Antioxidant Properties of Spices, Herbs and Other Sources* (Bab 3, hlm. 39–62). New York: Springer.
- Chen YS, Tawan C. 2020. Botany, diversity, and distribution of black pepper (*Piper nigrum* L.) cultivars in Malaysia. *Borneo Journal of Resource Science and Technology*, 10(1), 10–23. CLSI (Clinical and Laboratory Standards Institute). 2021. *Performance Standards for Antimicrobial Susceptibility Testing, 31<sup>st</sup> Edition*. CLSI Supplement M100, Wayne, PA, USA.
- Cronan JE. 2014. *Escherichia coli* as an experimental organism. Molecular Biology. John Wiley and Sons Ltd. *Advanced article*. doi: 10.1002/9780470015902.a0002026.pub2.

- Damanhoury ZA, Ahmad A. 2014. A Review on Therapeutic Potential of *Piper nigrum* L. (Black Pepper): The King of Spices. *Medicinal & Aromatic Plants*, 3, 161.
- Damanis IA, Utami R, Febriani N. 2020. Aktivitas antioksidan ekstrak etanol daun kemangi (*Ocimum sanctum* L.) dengan metode DPPH. *Jurnal Farmasi Higea*, 12(2), 79–84.
- De Silva DD, Crous PW, Ades PK, Hyde KD, Taylor PWJ. 2017. Life styles of Colletotrichum species and implications for plant biosecurity. *Fungal Biology Reviews*, 31(3), 155–168. <https://doi.org/10.1016/j.fbr.2017.05.001>
- Dion R, Maharani NA, Akbar MF, Wijayanti P, Nurlindasari Y. 2021. Review: Eksplorasi pemanfaatan jamur endofit pada tanaman *Curcuma* dan *Zingiber* sebagai penghasil senyawa antibakteri. *Jurnal Mikologi Indonesia*, 5(1), 16–29. [https://jmi.mikoina.or.id/jmi/article/download/167/pdf\\_1](https://jmi.mikoina.or.id/jmi/article/download/167/pdf_1)
- Dos Reis JBA, Adriana SL, Helson MM. 2022. Methods used for the study of endophytic fungi: A review on methodologies and challenges and associated tips. *Microorganisms*, 10(10), 2045. <https://doi.org/10.3390/microorganisms10102045>
- Efliani Y, Pangesti N, Triatmoko AA. 2023. Uji aktivitas antibakteri ekstrak etanol daun kelor (*Moringa oleifera*) terhadap bakteri *Staphylococcus aureus* dan *Escherichia coli*. *Jurnal Sains dan Kesehatan*, 14(1), 1–6.
- Emilda, Delfira N. 2023. Pemanfaatan Silika Gel 70-230 Mesh Bekas sebagai Pengganti Fase Diam Kromatografi Kolom pada Praktikum Kimia Organik. *Indonesian Journal of Laboratory*, Vol 6(1): 45-51.
- Emilda E, Delfira N. 2023. Pemanfaatan silika gel 70–230 mesh bekas sebagai pengganti fase diam kromatografi kolom pada praktikum kimia organik. *Indonesian Journal of Laboratory*, 6(1), 45–51.
- Evizal R. (2023). *Pengelolaan perkebunan lada*. Universitas Lampung. <https://repository.lppm.unila.ac.id/52612/1/PENGELOLAAN%20PERKEBUNAN%20LADA%20ok.pdf>
- Fadilturrahman H, Hafidh R, Aziz R. 2021. Aktivitas antioksidan ekstrak etanol daun kelor dengan metode DPPH. *Jurnal Fitofarmaka Indonesia*, 8(2), 60–65.
- Fajriaty I, Hidayat M, Sari D. 2024. In vitro and in silico studies of the potential cytotoxic and antioxidant activities of selected Indonesian medicinal plants. *Science Progress*, 107(2), 003685042311566.
- Fajriyah EN, Fitriyani PD, Ahmad M. 2020. Identifikasi senyawa aktif metabolit sekunder jamur endofit biji Juwet (*Syzygium cumini* L. Skeels) dan potensinya sebagai antioksidan. *Prosiding Seminar Nasional Sains dan Terapan UIN Raden Fatah*, 1–6. Diambil dari <http://repository.uin-malang.ac.id/7986/>
- Fathoni A, Ilyas M, Cahyana AH., Agusta A, Praptiwi T. 2013. Skrining dan isolasi metabolit aktif antibakteri kultur jamur endofit dari tumbuhan *Albortisia papuana* Becc. *Berita Biologi*, 12(3), 307–314. <https://doi.org/10.14203/beritabiologi.v12i3.639>

- Febriani N, Damanis IA, Lestari D. 2022. Evaluasi aktivitas antioksidan kombinasi ekstrak etanol daun kemangi dan daun sirih. *Jurnal Farmasi Galenika*, 8(1), 48–55.
- Gonçalves T, Oliveira MD, Barbosa JC. 2019. HPTLC-based chemical profiling: An approach to monitor plant metabolic expansion caused by fungal endophytes. *Metabolites*, 11(3), 174.
- Gonzalez-Pastor R, Carrera-Pacheco SE, Silvestre SM. 2023. Current landscape of methods to evaluate antimicrobial activity of natural extracts. *Antibiotics*, 12, 450.
- Grabowicz M, Silhavy TJ. 2023. A role for the Gram-negative outer membrane in bacterial shape. *Proceedings of the National Academy of Sciences of the United States of America*, 120(9), e2220709120.
- Hapida Y, Elfita, Widjajanti H, Salni. 2021. Biodiversity and antibacterial activity of endophytic fungi isolated from jambu bol (*Syzygium malaccense*). *Biodiversitas*, 22(12), 5668–5677.
- Hasriyani, Zulfa A, Anggun L, Murhayati R. 2020. Uji Aktivitas Antibakteri Ekstrak Etanol 70% Biji Lada Hitam (*Piper nigrum* L) terhadap Bakteri *Escherichia coli*. *Indonesia Jurnal Farmasi*, 5(2), 14–18.
- Husna F, Mita SR. 2020. Identifikasi bahan kimia obat dalam jamu tradisional *Stamina Pria* dengan metode kromatografi lapis tipis. *Farmaka*, 18(2), 16–25.
- Hyde KD, Petr B, Yanpeng C, KW Thilini C, Sybren DH, Mingkwan D, Antonio RG de F, Micael FMG, Didsanutda G, Heng G, Sandra H, Yuwei H, Ruvishika S, Jayawardena, Sabin K, Paul MK, Petr K, Thatsanee L, Sajeewa SNM, Ishara SM, Peter EM, Allen GTN, Monthien P, Birthe S, Indunil CS, Marc S, Frank S, Naritsada T, Dhanushka NW, Ali HB, Artapon W. 2024. Current trends, limitations, and future research in fungi and the biocircular economy. *Fungal Diversity*, 125, 1-71. <https://doi.org/10.1007/s13225-023-00532-5>
- Ibrahim MA, Nurul Aimi AMA. 2020. *The study of antioxidant activities of Piper sarmentosum and Piper nigrum*. *Tropical Agrobiodiversity (TRAB)*, 1(1), 1-3. DOI: <http://doi.org/10.26480/trab.01.2020.01.03>
- Ilyas M, Santoso T, Taufiq A, Kusdianti K. 2019. Isolasi dan Identifikasi Fungi Endofit pada Tumbuhan *Piperaceae* Asal Gunung Salak, Jawa Barat dan Kebun Raya Eka Karya, Bali. *Jurnal Biodjati*, 4(2), 241–251. <https://doi.org/10.15575/biodjati.v4i2.6074>
- Jamal HAA, Husaini A, Ngui S, Roslan HA, Zulkharnain A, Akinkunmi WAA. 2022. Characterization of bioactive compounds produced by endophytic fungi isolated from *Gynura procumbens* (Sambung Nyawa). *Brazilian Journal of Microbiology*, 53(4), 1857–1870.
- Jha P, Kaur T, Chhabra I, Panja A, Paul S, Kumar V, Malik, T. 2023. Endophytic fungi: Hidden treasure chest of antimicrobial metabolites interrelationship of endophytes and metabolites. *Frontiers in Microbiology*, 14, 1227830. <https://doi.org/10.3389/fmicb.2023.1227830>

- Jiang L, Qingxian M, Aijie L, Runze S, Genyun T, Xueshuang H, Hong P. 2023. Bioactive secondary metabolites produced by fungi of the genus *Diaporthe* (*Phomopsis*): structures, biological activities, and biosynthesis. *Arabian Journal of Chemistry*, 16, 105062.
- Kadeřábková N, Mahmood AJS, Mavridou DAI. 2024. Antibiotic susceptibility testing using minimum inhibitory concentration (MIC) assays. *Nature Reviews Microbiology*, 22(6), 324–337.
- Keller, N. P. (2019). *Fungal secondary metabolism: Regulation, function and drug discovery*. *Nature Reviews Microbiology*, 17(3), 167–180.
- Khan A, Farah K, Sana U, Muhammad, F, Leeza T, Muhammad TA, Asad R, Guoping Z. 2025. Plant Secondary Metabolites-Central Regulators Against Abiotic and Biotic Stresses. *Journal Metabolites*, 15(4): 276.
- Koche DK. 2018. *Role of secondary metabolites in plants' defense mechanism*. In *A Glimpse of Current Vistas Plant Science Research* (hlm. 1–16). Hislop College Publication Cell, Nagpur.
- Kowalska T, Sajewicz M. 2022. *Thin-Layer Chromatography (TLC) in the screening of botanicals – its versatile potential and selected applications*. *Molecules*, 27(19), 6607. <https://doi.org/10.3390/molecules27196607>
- Kumar A, Meena M, Ramdhani S. 2017. *Secondary metabolites from endophytic fungi: Production, methods of analysis, and diverse pharmaceutical potential*. *Symbiosis*, 90(2), 111–125. <https://doi.org/10.1007/s13199-023-00925-9>
- Kursia S, Aksa R, Nolo MM. 2018. Potensi antibakteri isolat jamur endofit dari daun kelor (*Moringa oleifera* Lam.). *Pharmauho: Jurnal Farmasi, Sains, dan Kesehatan*, 4(1), 30-33.
- Li H, Zhao Y, Chen L. 2023. Endophytic fungi mediates production of bioactive secondary metabolites via modulation of genes involved in key metabolic pathways. *3 Biotech*, 13,102.
- Li X, Chen Y, Zhang Z, Wang Y. 2021. Diversity and antibacterial activity of fungal endophytes from *Eucalyptus exserta*. *BMC Microbiology*, 21, 155.
- Lintang R, Losung F, Menajang FIS, Sumilat DA. 2024. Optimizing thin layer chromatography (TLC) eluent composition for compound content separation the ethanolic extract of sponge and ascidia. *Jurnal Ilmiah PLATAX*, 12(2), 132–138.
- Lukman H. 2016. Teknik bioautografi untuk skrining senyawa antibakteri dari tumbuhan. *Jurnal Biologi Tropis*, 16(2), 75–80.
- Makhoahle P. 2021. In vitro antibacterial screening of *Pappea capensis* extracts using the p-iodonitrotetrazolium chloride (INT) assay. *Pharmacologyonline*, 3, 595–601.
- Masrifah, Rahma N, Abram HP. 2017. Uji aktivitas ekstrak daun dan kulit labu air (*Lagennaria siceruruai* (Molina) Standl). *Jurnal Akad.Kim.* vol. 6(2): 96-106.
- Mirwan A. 2013 keberlakuan model HB-GFT sistem n-Heksana-Mek-Air pada ekstraksi cair-cair kolom isian. *Jurnal Konversi*, vol. 2(1).

- Missouri Botanical Garden. 2025. *Piper nigrum* - Plant Finder. <https://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=285067>
- Moon JK, and Shibamoto T. 2009. *Antioxidant assays for plant and food components*. *Journal of Agricultural and Food Chemistry*, 57(5), 1655–1666. <https://doi.org/10.1021/jf803537k>
- Msomu NZ, Imelane MB. 2018. C. *Herbal Medicine*. In: BUILDERS P. F (Ed.) *Herbal Medicine*. IntechOpen, London. <https://doi.org/10.5772/intechopen.72816>
- Nava-Solís U, García-González R, Hernández LE. 2022. Antimicrobial activity of the methanolic leaf extract of selected medicinal plants. *Scientific Reports*, 12, 25271. Nuraeni, T, Kodir A. 2021. Bioautografi: Metode untuk skrining aktivitas antibakteri. *Jurnal Bioeksakta*, 3(1), 13–17.
- Nurhayati LS, Yahdiyani N, Hidayatulloh A. 2020. Perbandingan Pengujian Aktivitas Antibakteri Starter Yogurt dengan Metode Difusi Sumuran dan Metode Difusi Cakram. *Jurnal teknologi Hasil Peternakan*, 1(2):41-46.
- Odigie E, Xu D, Lai D, Zhou L. 2024. Recent updates on the secondary metabolites from *Fusarium* fungi and their biological activities (covering 2019 to 2024). *Journal of Fungi*, 10(11), 778. <https://doi.org/10.3390/jof10110778>
- Ozyigit II, Dogan I, Hocaoglu-Ozyigit A, Yalcin B, Erdogan A, Yalcin E, Cabi E, Kaya Y. 2023. *Production of secondary metabolites using tissue culture-based biotechnological applications*. *Frontiers in Plant Science*, 14, 1132555. <https://doi.org/10.3389/fpls.2023.1132555>
- Pal N, Joshi M. 2023. *Piper nigrum*: An overview of effects on human health. *International Journal of Pharmacy Research & Technology*, 11(1), 25-32.
- Palazon J, Miguel AA. 2025. Secondary Metabolites in Plants. *Plants*, 14(14), 2146. <https://doi.org/10.3390/plants14142146>
- Plants of the World Online (POWO). 2024. *Piper nigrum* L. Royal Botanic Gardens, Kew. Retrieved October 17, 2025, from <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:682369-1>
- Pavithra G, Bindal S, Rana M, Srivastava S. 2020. Role of endophytic microbes against plant pathogens: A review. *Asian Journal of Plant Sciences*, 19(1), 54–62. <https://doi.org/10.3923/ajps.2020.54.62>
- Pham TM, Nguyen HL, Tran QT. 2023. The effects of curcumin-piperine supplementation on inflammatory, oxidative stress, and metabolic indices in patients with ischemic stroke in the rehabilitation phase: A randomized controlled trial. *Nutrition Journal*, 22(1), 90.
- Pontoh CMA, Buyung, AL. 2025. Inovasi Metode Kromatografi Gas (Gc) dalam Analisis Obat Analgesik. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 14(3).
- Praptiwi, Ridwan, Ahmad F. 2022. Chemical Compounds Profile by LC-MS/MS and Assessment of Antioxidant and Antibacterial properties of *Caesalpinia pubescens* Fruits Extracts. *Journal of Hunan University (Natural Science)*. Vol. 49(2). <https://doi.org/10.55463/issn.1674-2974.49.2.15>

- Pratama I, Tamrin T, Asyik N. 2023. Analisis antioksidan dan antibakteri lada hitam dan lada putih (*Piper nigrum* L.) dari Konawe Selatan. *Jurnal Sains dan Teknologi Pangan*, 8(4), 189–197.
- Pratiwi, Sylvia T. 2008. *Mikrobiologi Farmasi*. Jakarta: Erlangga
- Purnama YA, Handayani R. 2020. Ekstraksi minyak atsiri dari rimpang temu ireng (*Curcuma aeruginosa* Roxb.) dengan metode distilasi air. *Jurnal Teknologi Technoscintia*, 13(1), 83–91.
- Putri WR, Salmah S, Rizki M. 2017. Pengenalan morfologi bakteri dalam praktikum mikrobiologi. *Jurnal Sains dan Kesehatan*, 9(2), 80–85.
- Rahayu WP, Siti N, Ema K. 2018. *Escherichia coli: Patogenitas, Analisis dan Kajian Risiko*. Bogor: IPB Press.
- Ramadhani, A., Arifuddin, M., & Rusli, R. 2021. Profil kromatografi lapis tipis (KLT) ekstrak fungi endofit akar kuning (*Arcangelisia flava* L. Merr.). *Proceeding of Mulawarman Pharmaceuticals Conferences*, 13(1).
- Rasigade JP, Vandenesch F. 2014. *Staphylococcus aureus*: A pathogen with still unsolved issues. *Infection, Genetics and Evolution*, 21, 510–514.
- Rini N, Rohma DS. 2020. Struktur dan fungsi dinding sel bakteri Gram. *Jurnal Biologi Tropis*, 20(1), 10–18.
- Rollando R. 2019. Penelusuran potensi aktivitas antibakteri dan antioksidan fraksi kulit pohon Faloak (*Sterculia quadrifida* R.Br.). *Jurnal Farmasi (Journal of Pharmacy)*, 4(1), 26.
- Romero-Rodríguez A, Dávila JC, Dávila B, Rodríguez-Mora JD. 2018. Interplay between carbon, nitrogen and phosphate utilization in the control of secondary metabolite production in *Streptomyces*. *Archives of Microbiology*, 200(4), 517–527.
- Rosamah E. 2019. Kromatografi Lapis Tipis: Metode Sederhana dalam Analisis Kimia Tumbuhan Berkayu. *Mulawarman University Press*. Samarinda.
- Rui P, Xuelian B, Jianwei C, Huawei Z, Hong W. 2019. Exploring Structural Diversity of Microbe Secondary Metabolites Using OSMAC Strategy: A Literature Review. *Front Microbiol*. doi: [10.3389/fmicb.2019.00294](https://doi.org/10.3389/fmicb.2019.00294)
- Rumudatul A, Noor R, Sopandi S. 2021. Production of Secondary Metabolites and its Antibacterial and Antioxidant Activity During the Growth Period of Endophytic Fungi Isolated from Gall Rust Sengon Plants. *Pharmacognosy Journal*, 13(2), 325-331. DOI: 10.5530/pj.2021.13.42
- Rusmin MS. 2020. Modifikasi persyaratan lahan (iklim dan tanah) untuk pengembangan tanaman lada di Kabupaten Luwu Timur. *Skripsi*. Universitas Hasanuddin. [https://repository.unhas.ac.id/4622/2/G11116018\\_skripsi%201-2.pdf](https://repository.unhas.ac.id/4622/2/G11116018_skripsi%201-2.pdf)
- Sabina EP, Khan MR, Salma U. 2013. Antipyretic and analgesic activities of piperin isolated from *Piper nigrum* fruits in animal models. *Journal of Ethnopharmacology*, 145(1), 184–190. <https://doi.org/10.1016/j.jep.2012.10.026>
- Sandy YA, Djauhari S, Sektiono AW. 2015. Identifikasi Molekuler Jamur Antagonis *Trichoderma harzianum* Diisolasi Dari Tanah Pertanian Di Malang, Jawa Timur. *Journal of the Medical Association of Thailand*, 3(1), 1–8.

- Sari AIP, Fitriana F, Sitti A. 2022. Antibacterial activity of endophytic fungi isolated from Bidara roots (*Ziziphus mauritiana* Lam.) against bacteria that cause skin infections using TLC-bioautography. *Journal of Microbiology Science*, 4(1), Article 996.
- Sarkar S, Dey A, Kumar V, Batiha GES, El-Esawi MA, Tomczyk M, Ray P. 2021. Fungal endophyte: An interactive endosymbiont with the capability of modulating host physiology in myriad ways. *Frontiers in Plant Science*, 12, 701800.
- Saskiawan I, M Munir, SS Achmadi. 2016. Optimasi Produksi Serta Analisis Aktivitas Antioksidan dan Antimikroba Senyawa Ekspolisakarida Dari Jamur Tiram Putih (*Pleurotus ostreatus*) Pada Media Cair. *Berita Biologi*. 15 hal 113-140.
- Septian S, Dewi EN, Wijayanti I. 2017. Aktivitas antibakteri ekstrak lamun (*Cymodocea rotundata*) terhadap *Staphylococcus aureus* dan *Escherichia coli*. *Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology*, 13(1), 1–6. <https://doi.org/10.14710/ijfst.13.1.1-6>
- Shango AJ, Hussain SS, Memon MS. 2021. Morphological characterization and yield of pepper (*Piper nigrum* L.). *CABI Agriculture and Bioscience*, 2(1), 1-9.
- Sharma P, Singh S, Kaur G. 2023. Column chromatography coupled with TLC profiling for the separation and identification of bioactive phytochemicals from medicinal plant extracts. *Journal of Chromatography and Separation Techniques*, 14(2), 185–194.
- Singh VK, Kumar A. 2023. Secondary metabolites from endophytic fungi: Production, methods of analysis, and diverse pharmaceutical potential. *Symbiosis*, 90(2), 111–125.
- Singh A, Kumar V. 2024. Progress in endophytic fungi secondary metabolites: biosynthetic gene cluster reactivation and advances in metabolomics. *Bulletin of the National Research Centre*, 48, 150.
- Song E, Lee K, Kim J. 2022. Tetrazolium-based visually indicating bacteria sensor for real-time bacterial detection. *ACS Applied Materials & Interfaces*, 14(2), e2c08613.
- Sudarma IM, Susrama IGK, Suhartini NMP. 2021. Optimasi waktu inkubasi untuk produksi metabolit sekunder jamur endofit dari tumbuhan obat. *Jurnal Penelitian Bioteknologi*, 10(2), 45–55. <https://doi.org/10.xxxx/xxxx>
- Sulistiyawati W, Wahyudi, Trinuryono S. 2022. Analisis (Deskriptif Kuantitatif) Motivasi Belajar Siswa dengan Model Blended Learning di Masa Pandemi Covid-19. *Jurnal Kadikma*, 13 (1): 68-73.
- Suryani E, Pratiwi R, Handayani L. 2020. *Mikologi: Dasar dan praktikum*. Jakarta: Kencana Prenadamedia Group.
- Susanto E. 2019. *Peptide bioaktif sebagai antioksidan eksplorasi pada ceker ayam*. Yogyakarta: Deepublish.
- Syahmani, Leny, Iriani R, Elfa N. 2017. Penggunaan Kitin Sebagai Alternatif Fase Diam Kromatografi Lapis Tipis Dalam Praktikum Kimia Organik. *Jurnal Vidya Karya* (32), 1.

- Toghueo, R. M. K., and Boyom, F. F. 2020. Endophytes from ethnopharmacological plants: Sources of novel antioxidants—A systematic review. *Biocatalysis and Agricultural Biotechnology*, 23, 101484. <https://doi.org/10.1016/j.bcab.2019.101484>
- Toppo P, Kagatay LL, Gurung A, Singla P, Chakraborty R, Roy S. 2023. Endophytic fungi mediates production of bioactive secondary metabolites via modulation of genes involved in key metabolic pathways and their contribution in different biotechnological sector. *3 Biotech*, 13(6), 191. <https://doi.org/10.1007/s13205-023-03605-z>
- Triastuti A. 2022. Fungal endophytes as the source of medicinal natural product. *Jurnal Ilmiah Farmasi*, 16(1). <https://doi.org/10.20885/jif.vol16.iss1.art6>
- Ukey SS, Dayanand PG. 2024. *Phytochemical evaluation and in vitro antioxidant studies of Piper nigrum (L.)*. *Journal of Pharmacognosy and Phytochemistry*, 13(4): 386-395. DOI: <https://doi.org/10.22271/phyto.2024.v13.i4e.15029>
- Vemulapalli M, Palakuru P. 2024. A brief review on different chromatographic techniques. *Journal of Pharmaceutical Research*, 7(1), 294–299.
- Verma S, Ankan S, Roshita S, Chaitanya KD, Rajneesh KA. 2024. A Review on Secondary Metabolism in Anti-Diabetic Plants of Braj Region. *Int. J. Pharm. Sci*, 84(3): 57-66.
- Wang J, Wang Y, Jin Q. 2021. *Thin-layer chromatography bioautography as a screening tool for antimicrobial compounds*. *Pharmaceutical Biology*, 59(1), 215–225.
- Wang, H., Ziyue L, Fangfang D, Yan C, Kaidi Q, Qin X, Huiting L, Jun Z, Haibo T. 2023. *Isolation, identification, and antibacterial evaluation of endophytic fungi from Gannan navel orange*. *Frontiers in Microbiology*, 14, 1172629.
- Wen J, Chen J, Shen Q, Wang Y. 2022. Endophytic fungi: An effective alternative source of plant-derived secondary metabolites. *Applied Microbiology and Biotechnology*, 106(15–16), 5349–5364.
- Wulandari E, Handayani P. 2023. Aplikasi Kromatografi Lapis Tipis (KLT) dalam Analisis Senyawa Bioaktif. *Jurnal Sains dan Teknologi Farmasi*, 4(2), 1-10.
- Wulansari D, Qodrie ENP, Dharma B, Kamal AS, Hafid L, Marlina L, Praptiwi P. 2020. Aktivitas Antibakteri Ekstrak Kultur Jamur Endofit *Fusarium* sp. CSP-4 yang diisolasi dari *Curcuma sumatrana* Miq. *Berita Biologi*, 19 (1): 71-76.
- Yudiyanto. 2016. *Tanaman lada dalam perspektif auteknologi*. Bandar Lampung: AURA.
- Yusfachri P A, Purwaningrum Y, Asbur Y, Rahayu MS, Nurhayati. 2019. Pemanfaatan Kandungan Metabolit Sekunder yang Dihasilkan Tanaman pada Cekaman Biotik. *Agriland*, vol. 7(1): 39-47.
- Zakaria L. 2025. Plant Pathogenic and Endophytic *Colletotrichum fructicola*. *Microorganisms*, 13(7). <https://doi.org/10.3390/microorganisms13071465>
- Zhang L, Niaz SI, Khan D, Wang Z, Zhu Y, Zhou H, Lin Y, Li J, Liu L. 2017. Induction of diverse bioactive secondary metabolites from the mangrove endophytic fungus *Trichoderma* sp. (Strain 307) by co-cultivation with *Acinetobacter johnsonii* (Strain B2). *Marine Drugs*, 15(2), 35.

- Zhang H, Wang, X, Wang Y. 2017. Optimization of extraction process for bioactive compounds from endophytic fungi using ethyl acetate as solvent. *Journal of Applied Microbiology*, 122(3), 784–793.
- Zheng Y, Li Z, Ma Y. 2021. Endophytic fungi: A potential source of bioactive compounds. *Biotechnology Advances*, 47, 107707. <https://doi.org/10.1016/j.biotechadv.2021.107707>