UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Adil, M., Haider Abbasi, B., & Ul Haq, I. (2019). Red light controlled callus morphogenetic patterns and secondary metabolites production in *Withania somnifera* L. *Biotechnology Reports*, 24: e00380.

Aeschbach, R., Löliger, J., Scott, B. C., Murcia, A., Butler, J., Halliwell, B., & Aruoma, O. I. (1994). Antioxidant actions of thymol, carvacrol, 6-gingerol, zingerone and hydroxytyrosol. *Food and Chemical Toxicology*, 32(1): 31–36.

Aftab, T., Khan, M. M. A., da Silva, J. A. T., Idrees, M., & Naeem, M. (2011). Role of salicylic acid in promoting salt stress tolerance and enhanced artemisinin production in *Artemisia annua* L. *Journal of Plant Growth Regulation*, 30: 425–435.

Aftab, T., Khan, M. M. A., Idrees, M., Naeem, M., & Moinuddin. (2010). Salicylic acid acts as potent enhancer of growth, photosynthesis and artemisinin production in Artemisia annua L. *Journal of Crop Science and Biotechnology*, 13: 183–188.

Agoni, C., Olotu, F. A., Ramharack, P., & Soliman, M. E. (2020). Druggability and drug-likeness concepts in drug design: Are biomodelling and predictive tools having their say? *Journal of Molecular Modeling*, 26: 1–11.

Amberg, A. (2013). In Silico Methods. In: Vogel, H. G., Maas, J., Hock, F. J., & Mayer, D. (eds) *Drug Discovery and Evaluation: Safety and Pharmacokinetic Assays*. Springer, Berlin.

Ames-Sibin, A. P., Barizão, C. L., Castro-Ghizoni, C. V., Silva, F. M. S., Sá-Nakanishi, A. B., Bracht, L., Bersani-Amado, C. A., Marçal-Natali, M. R., Bracht, A., & Comar, J. F. (2018). β-Caryophyllene, the major constituent of copaiba oil, reduces systemic inflammation and oxidative stress in arthritic rats. *Journal of Cellular Biochemistry*, 119(12): 10262–10277.

Andrusier, N., Mashiach, E., Nussinov, R., & Wolfson, H. J. (2008). Principles of flexible protein–protein docking. *Proteins: Structure, Function, and Bioinformatics*, 73: 271–289.

Arab, M. M., Yadollahi, A., Shojaeiyan, A., & Shokri, S. (2014). Effects of nutrient media, different cytokinin types and their concentrations on in vitro multiplication of G×N15 (hybrid of almond×peach) vegetative rootstock. *Journal of Genetic Engineering and Biotechnology*, 12(2): 81–87.

Arizuka, N., Murakami, T., & Suzuki, K. (2017). The effect of β-caryophyllene on nonalcoholic steatohepatitis. *Journal of Toxicologic Pathology*, 30(4): 263–273.

Ashour, M., Wink, M., & Gershenzon, J. (2010). Biochemistry of terpenoids: monoterpenes, sesquiterpenes and diterpenes. In: Wink, M. (ed) *Annual Plant Reviews: Biochemistry of Plant Secondary Metabolism*. Wiley, New York.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Audain, E., Ramos, Y., Hermjakob, H., Flower, D. R., & Perez-Riverol, Y. (2016). Accurate estimation of isoelectric point of protein and peptide based on amino acid sequences. *Bioinformatics*, 32(6): 821–827.

Aziz L. M. S., Chan, L. K., & Lim, B. P. (2006). Pertumbuhan dan akumulasi alkaloid dalam kalus dan suspensi sel Eurycoma longifolia Jack. *Jurnal Ilmiah Pertanian Kultura*, 41(1): 19–27.

Azwin, Siregar, I. Z., & Supriyanto. (2006). Penggunaan BAP dan TDZ untuk perbanyakan tanaman gaharu (*Aquilaria malaccensis* Lamk.). *Media Konservasi*, 11(3): 98–104.

Bachmair, A., Finley, D., & Varshavsky, A. (1986). In vivo half-life of a protein is a function of its amino-terminal residue. *Science*, 234(4773): 179–186.

Backman, T. W., Cao, Y., & Girke, T. (2011). ChemMine tools: an online service for analyzing and clustering small molecules. *Nucleic Acids Research*, 39: W486–W491.

Baday, S. J. S. (2018). Plant tissue culture. *International Journal of Agriculture and Environmental Research*, 4(4): 977–990.

Beckman, C. H. (2000). Phenolic-storing cells: keys to programmed cell death and periderm formation in wilt disease resistance and in general defence responses in plants?. *Physiological and Molecular Plant Pathology*, 57(3): 101–110.

Bero, S. A., Muda, A. K., Choo, Y. H., Muda, N. A., & Pratama, S. F. (2017). Similarity measure for molecular structure: A brief review. *Journal of Physics: Conference Series*, 892: 012015.

Bhardwaj, M., Sali, V. K., Mani, S., & Vasanthi, H. R. (2020). Neophytadiene from *Turbinaria ornata* suppresses LPS-induced inflammatory response in RAW 264.7 macrophages and sprague dawley rats. *Inflammation*, 43(3): 937–950.

Bhatia, S. (2015). Plant Tissue Culture. In: Bhatia, S., Dahiya, R., Sharma, K., & Bera, T. (eds) *Modern Applications of Plant Biotechnology in Pharmaceutical Sciences*. Elsevier, Amsterdam.

Bitew, M., Desalegn, T., Demissie, T. B., Belayneh, A., Endale, M., & Eswaramoorthy, R. (2021). Pharmacokinetics and drug-likeness of antidiabetic flavonoids: Molecular docking and DFT study. *PLoS One*, 16(12): e0260853.

Block, R. & Lankes, C. (1996). Measures to prevent tissue browning of explants of the apple rootstock M9 during in vitro establishment. *Gartenbauwissenschaft*, 61(1): 11–17.

Buraphaka, H. & Putalun, W. (2020). Stimulation of health-promoting triterpenoids accumulation in *Centella asiatica* (L.) Urban leaves triggered by postharvest application of methyl jasmonate and salicylic acid elicitors. *Industrial Crops and Products*, 146: 112171.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Calderón, A. A., Zapata, J. M., Munoz, R., Pedreño, M. A., & Barceló, A. R. (1993). Resveratrol production as a part of the hypersensitive-like response of grapevine cells to an elicitor from *Trichoderma viride*. *New Phytologist*, 124(3): 455–463.

Cao, H., Pauff, J. M., & Hille, R. (2014). X-ray crystal structure of a xantin oxidase complex with the flavonoid inhibitor quercetin. *Journal of Natural Products*, 77(7): 1693–1699.

Cao, Y., Jiang, T., & Girke, T. (2008). A maximum common substructure-based algorithm for searching and predicting drug-like compounds. *Bioinformatics*, 24(13): i366–i374.

Cassells, A. C. (2012). Pathogen and Biological Contamination Management in Plant Tissue Culture: Phytopathogens, Vitro Pathogens, and Vitro Pests. In: Loyola-Vargas V. M. & Ochoa-Alejo, N. (eds) *Plant Cell Culture Protocols, Methods in Molecular Biology*. Vol. 877. Springer, Berlin.

Cassells, A. C. (2001). Contamination and its impact in tissue culture. *Acta Horticulturae*, (560): 353–359.

Chen, X. & Reynolds, C. H. (2002). Performance of similarity measures in 2D fragment-based similarity searching: comparison of structural descriptors and similarity coefficients. *Journal of Chemical Information and Computer Sciences*, 42(6): 1407–1414.

Choi, H. S., Song, H. S., Ukeda, H., & Sawamura, M. (2000). Radical-scavenging activities of citrus essential oils and their components: detection using 1,1-diphenyl-2-picrylhydrazyl. *Journal of Agricultural and Food Chemistry*, 48(9): 4156–4161.

Choudhuri, S. (2014). Additional Bioinformatic Analyses Involving Protein Sequences. In: Choudhuri, S. (ed) *Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools*. Academic Press, Massachusetts.

Conforti, F., Statti, G., Loizzo, M. R., Sacchetti, G., Poli, F., & Menichini, F. (2005). In vitro antioxidant effect and inhibition of alpha-amylase of two varieties of *Amaranthus caudatus* seeds. *Biological & Pharmaceutical Bulletin*, 28(6): 1098–1102.

Dahham, S., Tabana, Y., Iqbal, M., Ahamed, M., Ezzat, M., Majid, A., & Majid, A. (2015). The anticancer, antioxidant and antimicrobial properties of the sesquiterpene β-caryophyllene from the essential oil of *Aquilaria crassna*. *Molecules*, 20(7): 11808–11829.

Dalal, M. A., Sharma, B. B., & Rao, M. S. (1992). Studies on stock plant treatment and initiation culture mode in control of oxidative browning in in vitro cultures of grapevine. *Scientia Horticulturae*, 51(1–2): 35–41.

Das, K. & Roychoudhury, A. (2014). Reactive oxygen species (ROS) and response of antioxidants as ROS-scavengers during environmental stress in plants. *Frontiers in Environmental Science*, 2(53): 1–13.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Dasgupta, N., Chowdhury, P., & Das, S. (2015). Comparative adaptability assessment of two mangroves from Indian Sundarbans: some biochemical appearances. *Natural Science*, 7(12): 519–534.

Delgado, C., Mendez-Callejas, G., & Celis, C. (2021). Caryophyllene oxide, the active compound isolated from leaves of *Hymenaea courbaril* L. (Fabaceae) with antiproliferative and apoptotic effects on PC-3 androgen-independent prostate cancer cell line. *Molecules*, 26(20): 6142.

de Matos, C. K., Pereira, C. E. L., Balena, L., & Kawakami, J. (2020). Effect of agar concentration in culture medium on in vitro development of potato plant. *Research, Society and Development*, 9(7): 1–12.

Dixon, R. A. & Paiva, N. L. (1995). Stress-induced phenylpropanoid metabolism. *The Plant Cell*, 7(7): 1085–1097.

Du Preez, H. (2007). Squalene – antioxidant of the future?. *The South African Journal of Natural Medicine*, 33: 106–112.

Ebrahimi, M., Farhadian, N., Amiri, A. R., Hataminia, F., Soflaei, S. S., & Karimi, M. (2022). Evaluating the efficacy of extracted squalene from seed oil in the form of microemulsion for the treatment of COVID-19: A clinical study. *Journal of Medical Virology*, 94(1): 119–130.

Enroth, C., Eger, B. T., Okamoto, K., Nishino, T., Nishino, T., & Pai, E. F. (2000). Crystal structures of bovine milk xanthine dehydrogenase and xanthine oxidase: structure-based mechanism of conversion. *Proceedings of the National Academy of Sciences of the United States of America*, 97(20): 10723–10728.

Evans, D. E., Coleman, J. O. D., & Kearns, A. (2003). *Plant Cell Culture*. BIOS Scientific Publishers, London.

Fadillioglu, E., Kurcer, Z., Parlakpinar, H., Iraz, M., & Gursul, C. (2008). Melatonin treatment against remote organ injury induced by renal ischemia reperfusion injury in diabetes mellitus. *Archives of Pharmacal Research*, 31(6): 705–712.

Fadlan, A. & Nusantoro, Y. R. (2020). Analisis sifat mirip obat, prediksi ADMET, dan penambatan molekular isatinil-2-aminobenzoilhidrazon dan kompleks logam transisi Co(II), Ni(II), Cu(II), Zn(II) terhadap BCL2-XL. *Akta Kimia Indonesia*, 5(2): 114–126.

Faqiha, A. F., Indrawijaya, Y. Y. A., Suryadinata, A., Amiruddin, M., & Mutiah, R. (2022). Potensi senyawa nitazoxanide dan arbidol sebagai antivirus SARS-CoV-2 terhadap reseptor NSP5 (7BQY dan 2GZ7) dan ACE2 (3D0G dan 1R4L). *Journal of Food and Pharmaceutical Sciences*, 10(1): 570–583.

Fazili, M. A., Bashir, I., Ahmad, M., Yaqoob, U., & Geelani, S. N. (2022). In vitro strategies for the enhancement of secondary metabolite production in plants: a review. *Bulletin of the National Research Centre*, 46(1): 35.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Ferrari, A. M., Wei, B. Q., Costantino, L., & Shoichet, B. K. (2004). Soft docking and multiple receptor conformations in virtual screening. *Journal of Medicinal Chemistry*, 47(21): 5076–5084.

Ferreira, L. G., Dos Santos, R. N., Oliva, G., & Andricopulo, A. D. (2015). Molecular docking and structure-based drug design strategies. *Molecules*, 20: 13384–13421.

Fink, R. C. & Scandalios, J. G. (2002). Molecular evolution and structure – function relationships of the superoxide dismutase gene families in angiosperms and their relationship to other eukaryotic and prokaryotic superoxide dismutases. *Archives of Biochemistry and Biophysics*, 399(1): 19–36.

Francomano F., Caruso A., Barbarossa A., Fazio A., La Torre C., Ceramella J., Mallamaci R., Saturnino C., Iacopetta D., & Sinicropi M. S. (2019). β-caryophyllene: A sesquiterpene with countless biological properties. *Applied Sciences*, 9: 5420.

Fridovich, I. (1995). Superoxide radical and superoxide dismutases. *Annual Review of Biochemistry*, 64: 97–112.

Gadaleta, D., Vuković, K., Toma, C., Lavado, G. J., Karmaus, A. L., Mansouri, K., Kleinstreuer, N. C., Benfenati, E., & Roncaglioni, A. (2019). SAR and QSAR modeling of a large collection of LD_{50} rat acute oral toxicity data. *Journal of Cheminformatics*, 11(1): 58.

Gao, Y., Gesenberg, C., & Zheng, W. (2017). Oral Formulations for Preclinical Studies: Principle, Design, and Development Considerations. In: Qiu, Y., Chen, Y., Zhang, G. G. Z., Yu, L., & Mantri, R. V. (eds) *Developing Solid Oral Dosage Forms*. Elsevier, Amsterdam.

Gasteiger, E., Hoogland, C., Gattiker, A., Duvaud, S., Wilkins, M. R., Appel, R. D., & Bairoch, A. (2005). Protein Identification and Analysis Tools on the ExPASy Server. In: Walker, J. M. (ed) *The Proteomics Protocols Handbook*. Humana Press.

Gertsch, J., Leonti, M., Raduner, S., Racz, I., Chen, J.Z., Xie, X.Q., Altmann, K.H., Karsak, M., & Zimmer, A. (2008). Beta-caryophyllene is a dietary cannabinoid. *Proceedings of the National Academy of Sciences of the United States of America*, 105(26): 9099–9104.

Ghallab, D. S., Shawky, E., Metwally, A. M., Celik, I., Ibrahim, R. S., & Mohyeldin, M. M. (2022). Integrated in silico–in vitro strategy for the discovery of potential xantin oxidase inhibitors from Egyptian propolis and their synergistic effect with allopurinol and febuxostat. *Royal Society of Chemistry Advances*, 12(5): 2843–2872.

Gill, S. C. & von Hippel, P. H. (1989). Calculation of protein extinction coefficients from amino acid sequence data. *Analytical Biochemistry*, 182(2): 319–326.

Gonda, D. K., Bachmair, A., Wünning, I., Tobias, J. W., Lane, W. S., & Varshavsky, A. (1989). Universality and structure of the N-end rule. *The Journal of Biological Chemistry*, 264(28): 16700–16712.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Grogan, S. & Preuss, C. V. (2022). Pharmacokinetics. In: *StatPears*. StatPearls Publishing.

Hadi, S., Lestari, D., Dharmayani, N. K. T., Ratnasari, B. D., Ito, M., Yamada, I., & Mulyaningsih, T. (2020). Investigation of anticancer agents from the bark of *Gyrinops versteegii* (Gilg.) Domke from Lombok island. *Oriental Journal of Chemistry*, 36(6): 1037–1042.

Halder, M., Sharkar, S., & Jha, S. (2019). Elicitation: A biotechnological tool for enhanced production of secondary metabolites in hairy root cultures. *Engineering Life Science*, 19(12): 880–895.

Halliwell, B. (1995). How to characterize an antioxidant: an update. *Biochemical Society Symposium*, 61: 73–101.

Halliwell, B. (2006). Reactive species and antioxidants. Redox biology is a fundamental theme of aerobic life. *Plant Physiology*, 141(2): 312–322.

Hammami, S., Jmii, H., El Mokni, R., Khmiri, A., Faidi, K., Dhaouadi, H., El Aouni, M. H., Aouni, M., & Joshi, R. K. (2015). Essential oil composition, antioxidant, cytotoxic and antiviral activities of *Teucrium pseudochamaepitys* growing spontaneously in Tunisia. *Molecules*, 20(11): 20426–20433.

Hariyati, M., Bachtiar, I., & Sedijani, P. (2016). Induksi kalus tanaman krisan (Chrysanthemum morifolium) dengan pemberian benzil amino purin (BAP) dan dichlorofenoksi acetil acid (2,4 D). *Jurnal Penelitian Pendidikan IPA*, 2(1): 89–96.

Hasnain, A., Naqvi, S. A. H., Ayesha, S. I., Khalid, F., Ellahi, M., Iqbal, S., Hassan, M. Z., Abbas, A., Adamski, R., Markowska, D., Baazeem, A., Mustafa, G., Moustafa, M., Hasan, M. E., & Abdelhamid, M. M. A. (2022). Plants in vitro propagation with its applications in food, pharmaceuticals and cosmetic industries; current scenario and future approaches. *Frontiers in Plant Science*, 13: 1009395.

Hayat, Q., Hayat, S., Irfan, M., & Ahmad, A. (2010). Effect of exogenous salicylic acid under changing environment: A review. *Environmental and Experimental Botany*, 68(1): 14–25.

He, Y., Guo, X., Lu, R., Niu, B., Pasapula, V., Hou, P., Cai, F., Xu, Y., & Chen, F. (2009). Changes in morphology and biochemical indices in browning callus derived from *Jatropha curcas* hypocotyls. *Plant Cell Tissue Organ Culture*, 98: 11–17.

Hendra, R., Ahmad, S., Oskoueian, E., Sukari, A., Shukor, M. Y. (2011). Antioxidant, anti-inflammatory and cytotoxicity of *Phaleria macrocarpa* (Boerl.) Scheff fruit. *BMC Complementary and Alternative Medicine*, 11: 110.

Hollingsworth, S. A., & Karplus, P. A. (2010). A fresh look at the Ramachandran plot and the occurrence of standard structures in proteins. *Biomolecular Concepts*, 1(3–4): 271–283.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Hopia, A. I., Huang, S.-W., Schwarz, K., German, J. B., & Frankel, E. N. (1996). Effect of different lipid systems on antioxidant activity of rosemary constituents carnosol and carnosic acid with and without a-tocopherol. *Journal of Agricultural and Food Chemistry*, 44(8): 2030–2036.

Huang, S. Y. (2018). Comprehensive assessment of flexible-ligand docking algorithms: current effectiveness and challenges. *Briefings in Bioinformatics*, 19(5): 982–994.

ITIS. (2011). *Gyrinops versteegii* (Gilg.) Domke. https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=845834#null. Diakses pada 20 Februari 2022.

Jendele, L., Krivák, R., Skoda, P., Novotny, M., & Hoksza, D. (2019). PrankWeb: a web server for ligand binding site prediction and visualization. *Nucleic Acids Research*, 47(W1): W345–W349.

Jones, A. M. & Saxena, P. K. (2013). Inhibition of phenylpropanoid biosynthesis in *Artemisia annua* L.: a novel approach to reduce oxidative browning in plant tissue culture. *PLoS One*, 8(10): e76802.

Jung, J. I., Kim, E. J., Kwon, G. T., Jung, Y. J., Park, T., Kim, Y., Yu, R., Choi, M. S., Chun, H. S., Kwon, S. H., Her, S., Lee, K. W., & Park, J. H. (2015). β-Caryophyllene potently inhibits solid tumor growth and lymph node metastasis of B16F10 melanoma cells in high-fat diet-induced obese C57BL/6N mice. *Carcinogenesis*, 36(9): 1028–1039.

Karakaya, S., Yilmaz, S. V., Özdemir, Ö., Koca, M. S., Pınar, N. M., Demirci, B., Yıldırım, K., Sytar, O., Turkez, H., & Baser, K. H. (2020). A caryophyllene oxide and other potential anticholinesterase and anticancer agent in *Salvia verticillata* subsp. amasiaca (Freyn & Bornm.) Bornm. (Lamiaceae). *Journal of Essential Oil Research*, 32: 512–525.

Karuppusamy, S. (2009). A review on trends in production of secondary metabolites from higher plants by in vitro tissue, organ and cell cultures. *Journal of Medicinal Plants Research*, 3: 1222–1239.

Kasote, D. M., Katyare, S. S., Hegde, M. V., & Bae, H. (2015). Significance of antioxidant potential of plants and its relevance to therapeutic applications. *International Journal of Biological Sciences*, 11(8): 982–991.

Kim, M. T., Sedykh, A., Chakravarti, S. K., Saiakhov, R. D., & Zhu, H. (2014). Critical evaluation of human oral bioavailability for pharmaceutical drugs by using various cheminformatics approaches. *Pharmaceutical Research*, 31(4): 1002–1014.

Kim, S. K. & Karadeniz, F. (2012). Biological Importance and Applications of Squalene and Squalane. In: Kim, S. K. (ed) *Advances in Food and Nutrition Research*. Vol. 65. Academic Press, Massachusetts.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Klauke, A. L., Racz, I., Pradier, B., Markert, A., Zimmer, A. M., Gertsch, J., & Zimmer, A. (2014). The cannabinoid CB_2 receptor-selective phytocannabinoid beta-caryophyllene exerts analgesic effects in mouse models of inflammatory and neuropathic pain. *European Neuropsychopharmacology*, 24(4): 608–620.

Kotomori, S. N. & Murashige, T. (1965). Some aspects of aseptic propagation of orchids. *American Orchid Society Bulletin*, 34: 484–489.

Krivák, R. & Hoksza, D. (2018). P2Rank: machine learning based tool for rapid and accurate prediction of ligand binding sites from protein structure. *Journal of Cheminformatics*, 10(1): 39.

Kumar, R., Sharma, A., & Varadwaj, P. K. (2011). A prediction model for oral bioavailability of drugs using physicochemical properties by support vector machine. *Journal of Natural Science, Biology, and Medicine*, 2(2): 168–173.

Lagunin, A., Stepanchikova, A., Filimonov, D., & Poroikov, V. (2000). PASS: prediction of activity spectra for biologically active substances. *Bioinformatics*, 16: 747–748.

Langhasova, L. , Hanusova V., Rezek J., Stohanslova B., Ambroz M., Kralova V., Vanek, T., Lou, J. D., Yun, Z. L., Yang, J., & Skalova, L. (2014). Essential oil from *Myrica rubra* leaves inhibits cancer cell proliferation and induces apoptosis in several human intestinal lines. *Industrial Crops and Products*, 59(10): 20–26.

Lexa, K. W. & Carlson, H. A. (2012). Protein flexibility in docking and surface mapping. *Quarterly Reviews of Biophysics*, 45(3): 301–343.

Lindsey, C. W. (2014). Lipophilicity. In: Stolerman, I. P. & Price, L. H. (eds) *Encyclopedia of Psychopharmacology*. Springer, Berlin.

Lipinski, C. A., Lombardo, F., Dominy, B. W., & Feeney, P. J. (2001). Experimental and computational approaches to estimate solubility and permeability in drug discovery and development settings. *Advanced Drug Delivery Reviews*, 46(1-3): 3–26.

Liu, Y., Yang, X., Gan, J., Chen, S., Xiao, Z. X., & Cao, Y. (2022). CB-Dock2: improved protein-ligand blind docking by integrating cavity detection, docking and homologous template fitting. *Nucleic Acids Research*, 50(W1): W159–W164.

Lizawati, L. (2012). Induksi kalus embriogenik dari eksplan tunas apikal tanaman jarak pagar (*Jatropha curcas* L.) dengan penggunaan 2,4-D dan TDZ. *Bioplantae*, 1(2): 75–77.

Lozano-Grande, M. A., Gorinstein, S., Espitia-Rangel, E., Dávila-Ortiz, G., & Martínez-Ayala, L. (2018). Plant sources, extraction methods, and uses of squalene. *International Journal of Agronomy*, 2018(5): 1-13.

Maleknia, S. D. & Adams, M. A. (2007). *Reactions of oxygen-containing terpenes with peptides and proteins*. Proceedings of the 4th International Peptide Symposium, Australian Peptide Association, Australia, pp. 334–335.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Mardhiyetti, M., Syarif, Z., Jamarun, N., & Suliansyah, I. (2017). Pengaruh BAP (benzil adenin purin) dan NAA (naphthalene acetic acid) terhadap ekstrak tanaman turi (*Sesbania grandiflora*) dalam media multiplikasi in vitro. *Pastura*, 5(1): 35–38.

Marisa, F. (2021). *Induksi Pembentukan Terpenoid pada Gaharu (Gyrinops versteegii (Gilg) Domke) secara In Vitro* [Tesis, Universitas Gadjah Mada].

Martin, Y. C., Kofron, J. L., & Traphagen, L. M. (2002). Do structurally similar molecules have similar biological activity?. *Journal of Medicinal Chemistry*, 45(19): 4350–4358.

Masita, R., Nuringtyas, T. R., Wijayanti, N., & Hidayati, L. (2020). Antiviral activity of agarwood *Aquilaria malaccensis* Lamk. and *Gyrinops versteegii* (Gilg.) Domke leaves ethanolic against dengue serotype 3 virus in vitro. *AIP Conference Proceedings*, 2231: 040077.

McVaugh, R. (1984). Compositae. In: Anderson, W. R. (ed) Flora Novo-Galiciana. *A Descriptive Account of the Vascular Plants of Western Mexico*. Vol. 12, University of Michigan Press, Ann Arbor.

Medeiros, R., Passos, G. F., Vitor, C. E., Koepp, J., Mazzuco, T. L., Pianowski, L. F., Campos, M. M., & Calixto, J. B. (2007). Effect of two active compounds obtained from the essential oil of *Cordia verbenacea* on the acute inflammatory responses elicited by LPS in the rat paw. *British Journal of Pharmacology*, 151(5): 618–627.

Mertens, H. D. & Gooley, P. R. (2005). Validating the use of database potentials in protein structure determination by NMR. *FEBS Letters*, 579(25): 5542–5548.

Miller, L. R. & Murashige, T. (1976). Tissue culture propagation of tropical foliage plants. *In Vitro*, 12(12): 797–813.

Misra, B. B. & Dey, S. (2013). Evaluation of in vivo anti-hyperglycemic and antioxidant potentials of α-santalol and sandalwood oil. *Phytomedicine*, 20(5): 409–416.

Mohankumar, A., Kalaiselvi, D., Thiruppathi, G., Muthusaravanan, S., Nivitha, S., Levenson, C., Tawata, S., & Sundararaj, P. (2020). α- and β-santalols delay aging in *Caenorhabditis elegans* via preventing oxidative stress and protein aggregation. *ACS Omega*, 5(50): 32641–32654.

Mohankumar, A., Shanmugam, G., Kalaiselvi, D., Levenson, C., Nivitha, S., Thiruppathi, G., & Sundararaj, P. (2018). East Indian sandalwood (*Santalum album* L.) oil confers neuroprotection and geroprotection in *Caenorhabditis elegans* via activating SKN-1/Nrf2 signaling pathway. *Royal Society of Chemistry Advances*, 8(59): 33753–33774.

Morris, G. M., Huey, R., Lindstrom, W., Sanner, M. F., Belew, R. K., Goodsell, D. S., & Olson, A. J. (2009). AutoDock4 and AutoDockTools4: Automated docking with selective receptor flexibility. *Journal of Computational Chemistry*, 30(16): 2785–2791.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Mulyaningsih, T. & Yamada, I. (2008). Notes on Some Species of Agarwood in Nusa Tenggara, Celebes and West Papua. In: *Natural Resource Management and Socio-Economic Transformation under the Decentralization in Indonesia: Toward Sulawesi Area Studies*. CSEAS. Kyoto University, Kyoto.

Muna, P. I. (2023). *Profil Senyawa Terpenoid Kalus Gaharu Gyrinops versteegii (Gilg.) Domke Hasil Elisitasi Asam Salisilat dan Potensinya sebagai Inhibitor ACE-2* [Skripsi, Universitas Gadjah Mada].

Munasinghe S. P., Somaratne, S., Weerakoon, S. R., & Ranasinghe, C. (2020). Prediction of chemical composition for callus production in *Gyrinops walla* Gaertner through machine learning. *Information Processing in Agriculture*, 7(4): 511–522.

Munasinghe, S., Somaratne, S., Weerakoon, S., & Ranasinghe, C. (2021). Sustainable utilization of *Gyrinops walla* Gaetner: in vitro production of sesquiterpenes by chemical and biological elicitation. *Journal of Genetic Engineering and Biotechnology*, 19(1): 134.

Muralikrishna, A. (1988). Development of micropropagation strategies in pomegranate, grape and guava cultivars. *Physiologia Plantarum*, 15: 473–497.

Murkute, M., Patil, S., & Singh, S. K. (2004). In vitro regeneration in pomegranate cv. Ganesh from mature plant. *Indian Journal of Horticulture*, 61(3): 206–208.

Naeem, M., Sadiq, Y., Jahan, A., Nabi, A., Aftab, T., & Khan, M. M. A. (2020). Salicylic acid restrains arsenic induced oxidative burst in two varieties of *Artemisia annua* L. by modulating antioxidant defence system and artemisinin production. *Ecotoxicology and Environmental Safety*, 202: 110851.

Namdeo, A. G. (2007). Plant cell elicitation for production of secondary metabolites: A review. *Pharmacognosy Reviews*, 1(1): 69–79.

Nasution, A. A., Siregar, U. J., & Miftahudin. (2019). Identification of chemical compounds in agarwood-producing species *Aquilaria malaccensis* and *Gyrinops versteegii*. *Journal of Forestry Research*, 31: 1371–1380.

Newmark, H. L. (1999). Squalene, olive oil, and cancer risk. Review and hypothesis. *Annals of the New York Academy of Sciences*, 889: 193–203.

Ningsih, I. Y. (2014). Pengaruh elisitor biotik dan abiotik pada produksi flavonoid melalui kultur jaringan tanaman. *Pharmacy*, 11(2): 117–131.

Nugraha, R. Y. B., Faratisha, I. F. D., Mardhiyyah, K., Ariel, D. G., Putri, F. F., Nafisatuzzamrudah, Winarsih, S., Sardjono, T. W., & Fitri, L. E. 2020. Antimalarial properties of isoquinoline derivative from *Streptomyces hygroscopicus* subsp. Hygroscopicus: An in silico approach. *BioMed Research International*, 1–15.

Nugroho, L. H. & Verpoorte, R. (2002). Secondary metabolism in tobacco. *Plant Cell, Tissue and Organ Culture*, 68: 105–125.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Nugroho, L. H. (2017). *Struktur dan Produk Jaringan Sekretori Tumbuhan*. Gadjah Mada University Press, Yogyakarta.

Nuringtyas, T. R., Isromarina, R., Septia, Y., Hidayati, L., Wijayanti, N., & Moeljopawiro, S. (2018). The antioxidant and cytotoxic activities of the chloroform extract of agarwood (*Gyrinops versteegii* (Gilg.) Domke) leaves on HeLa cell lines. *AIP Conference Proceedings*, 2002: 020067.

Nurpratama, J. M. (2020). *Uji Toksisitas Ekstrak Metanol Daun Gaharu (Gyrinops versteegii (Gilg.) Domke) sebagai Upaya Pencarian Bahan Aktif Antikanker* [Skripsi, Universitas Mataram].

Okudera, Y. & Ito, M. (2009). Production of agarwood fragrant constituents in *Aquilaria calli* and cell suspension cultures. *Plant Biotechnology*, 26(3): 307–315.

Okugawa, H., Ueda, R., Matsumoto, K., Kawanishi, K., & Kato, A. (1995). Effect of α-santalol and β-santalol from sandalwood on the central nervous system in mice. *Phytomedicine*, 2(2): 119–126.

Olugbami, J. O., Gbadegesin, M. A., & Odunola, O. A. (2014). In vitro evaluation of the antioxidant potential, phenolic and flavonoid contents of the stem bark ethanol extract of *Anogeissus leiocarpus*. *African Journal of Medicine and Medical Sciences*, 43(Suppl 1): 101–109.

Pacher, P., Nivorozhkin, A., & Szabó, C. (2006). Therapeutic effects of xantin oxidase inhibitors: renaissance half a century after the discovery of allopurinol. *Pharmacological Reviews*, 58(1): 87–114.

Pan, Y., Li, L., Xiao, S., Chen, Z., Sarsaiya, S., Zhang, S., ShangGuan, Y., Liu, H., & Xu, D. (2020). Callus growth kinetics and accumulation of secondary metabolites of *Bletilla striata* Rchb.f. using a callus suspension culture. *PLoS One*, 15(2): e0220084.

Papas, A. M. (1999). Diet and antioxidant status. *Food and Chemical Toxicology*, 37(9–10): 999–1007.

Parwata, A., Manuaba, P., & Yasa, S. (2018). The potency of flavonoid compounds in water extract *Gyrinops versteegii* leaves as natural antioxidants sources. *Biomedical and Pharmacology Journal*, 11(3): 1501–1511.

Paulpandi, M., Kannan, S., Thangam, R., Kaveri, K., Gunasekaran, P., & Rejeeth, C. (2012). In vitro anti-viral effect of β-santalol against influenza viral replication. *Phytomedicine*, 19(3–4): 231–235.

Pham, D. M., Boussouira, B., Moyal, D., & Nguyen, Q. L. (2015). Oxidization of squalene, a human skin lipid: a new and reliable marker of environmental pollution studies. *International Journal of Cosmetic Science*, 37(4): 357–365.

Pham-Huy, L. A., He, H., & Pham-Huy, C. (2008). Free radicals, antioxidants in disease and health. *International Journal of Biomedical Science*, 4(2): 89–96.

Pichersky, E. & Raguso, R. A. (2016). Why do plants produce so many terpenoid compounds?. *New Phytologist*, 220(3): 692–702.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Pieterse, C. M. & van Loon, L. C. (1999). Salicylic acid-independent plant defence pathways. *Trends in Plant Science*, 4(2): 52–58.

Pollastri, M. P. (2010). Overview on the rule of five. *Current Protocols in Pharmacology*, 49: 9–12.

Power, H., Wu, J., Turville, S., Aggarwal, A., Valtchev, P., Schindeler, A., & Dehghani, F. (2022). Virtual screening and in vitro validation of natural compound inhibitors against SARS-CoV-2 spike protein. *Bioorganic Chemistry*, 119: 105574.

Price, G. & Patel, D. A. (2022). Drug Bioavailability. In: *StatPearls*. StatPearls Publishing.

Purwianingsih, W., Febri, S., & Kusdianti. (2016). Formation flavonoid secondary metabolites in callus culture of *Chrysanthemum cinerariaefolium* as alternative provision medicine. *AIP Conference Proceedings*, 1708(1): 1–5.

Pyrzynska, K. & Pekal, A. J. (2013). Application of free radical diphenylpicrylhydrazyl (DPPH) to estimate the antioxidant capacity of food samples. *Analytical Methods*, 5(17): 4288–4295.

Rao, C. V., Newmark, H. L., & Reddy, B. S. (1998). Chemopreventive effect of squalene on colon cancer. *Carcinogenesis*, 19(2): 287–290.

Richheimer, S. L., Bernart, M.W., King, G. A., Kent,M. C., & Bailey, D. T. (1996). Antioxidant activity of lipid soluble phenolic diterpenes from rosemary. *Journal of the American Oil Chemists' Society*, 73: 507–514.

Rodriguez, E., Towers, G. H. N., & Mitchell, J. C. (1976). Biological activities of sesquiterpene lactones. *Phytochemistry*, 15(11): 1573–1580.

Ruberto, G. & Baratta, M. T. (2000). Antioxidant activity of selected essential oil components in two lipid model systems. *Food Chemistry*, 69(2): 167–174.

Sabeena, K. H. F., Anandan, R., Kumar, S. H., Shiny, K. S., Sankar, T. V., & Thankappan, T. K. (2004). Effect of squalene on tissue defense system in isoproterenol-induced myocardial infarction in rats. *Pharmacological Research*, 50(3): 231–236.

Sabulal, B., Dan, M., J, A. J., Kurup, R., Pradeep, N. S., Valsamma, R. K., & George, V. (2006). Caryophyllene-rich rhizome oil of Zingiber nimmonii from South India: Chemical characterization and antimicrobial activity. *Phytochemistry*, 67(22): 2469–2473.

Saikia, M., Shrivastava, K., Singh, S. S. (2013). Effect of culture media and growth hormones on callus induction in *Aquilaria malaccensis* Lam., a medically and commercially important tree species of north east India. *Asian Journal of Biological Sciences*, 6(2): 96–105.

Sák, M., Dokupilová, I., Kaňuková, Š., Mrkvová, M., Mihálik, D., Hauptvogel, P., & Kraic, J. (2021). Biotic and abiotic elicitors of stilbenes production in *Vitis vinifera* L. cell culture. *Plants*, 10(3): 490.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Santos-Sánchez, N. F., Salas-Coronado, R., Villanueva-Cañongo, C., & Hernández-Carlos, B. (2019). Antioxidant Compounds and Their Antioxidant Mechanism. In: Shalaby, E. A. (ed) *Antioxidants*. IntechOpen.

Scandalios, J. G. (1997a). *Oxidative Stress and the Molecular Biology of Antioxidant Defenses*. Cold Spring Harbor Laboratory Press, New York.

Scandalios, J. G. (1997b). Molecular genetics of superoxide dismutases. In: Scandalios, J. G. (ed) *Oxidative Stress and the Molecular Biology of Antioxidant Defenses*. Cold Spring Harbor Laboratory Press, New York.

Scandalios, J. G. (2005). Oxidative stress: molecular perception and transduction of signals triggering antioxidant gene defenses. *Brazilian Journal of Medical and Biological Research*, 38(7): 995–1014.

Scandalios, J. G., Guan, L., & Polidoros, A. N. (1997). Catalases in plants: Gene structure, properties, regulation, and expression. In: Scandalios, J. G. (ed) *Oxidative Stress and the Molecular Biology of Antioxidant Defenses*. Cold Spring Harbor Laboratory Press, New York.

Schwarz, K., Ernst, H., & Ternes, W. (1996). Evaluation of antioxidant constituents of thyme. *Journal of the Science of Food and Agriculture*, 70(2): 217–223.

Semprini, R., Martorana, A., Ragonese, M., & Motta, C. (2018). Observational clinical and nerve conduction study on effects of a nutraceutical combination on painful diabetic distal symmetric sensory-motor neuropathy in patients with diabetes type 1 and type 2. *Minerva Medica*, 109(5): 358–362.

Setiawansyah, A. & Gemantari, B. M. (2022). Potential activity of caryophyllene derivatives as xantin oxidase inhibitor: An in silico quantitative structure-activity relationship analysis. *Journal of Food and Pharmaceutical Sciences*, 10(3): 700–708.

Setiawansyah, A., Reynaldi, M. A., Tjahjono, D. H., & Sukrasno, S. (2022). Molecular docking-based virtual screening of antidiabetic agents from songga (*Strychnos lucida* R.Br.): an Indonesian native plant. *Current Research on Biosciences and Biotechnology*, 3(2): 208–214.

Shalaby, E. A. & Shanab, S. M. M. (2013). Antioxidant compounds, assays of determination and mode of action. *African Journal of Pharmacy and Pharmacology*, 7(10): 528–539.

Sharma, M., Levenson, C., Clements, I., Castella, P., Gebauer, K., & Cox, M. E. (2017). East Indian Sandalwood Oil (EISO) alleviates inflammatory and proliferative pathologies of psoriasis. *Frontiers in Pharmacology*, 8: 125.

Sharma, H. & Vashistha, B. D. (2015). Plant tissue culture: A biological tool for solving the problem of propagation of medicinally important woody plants - A review. *Advanced Research*, 3(2): 402–411.

Singh, S., Baker, Q. B., & Singh, D. B. (2022). Molecular docking and molecular dynamics simulation. In: Singh, D. B. & Pathak, R. K. (eds) *Bioinformatics*, chap. 18: 291–304.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Singh, S. K. & Khawale, R. N. (2006). Plantlet regeneration from nodal segments of pomegranate (*Punica granatum*) cv. Jyoti. *Plant Biotechnology and Its Applications in Tissue Culture* (Chapter 12, pp. 107–113).

Singh, G., Marimuthu, P., de Heluani, C. S., & Catalan, C. A. (2006). Antioxidant and biocidal activities of *Carum nigrum* (seed) essential oil, oleoresin, and their selected components. *Journal of Agricultural and Food Chemistry*, 54(1): 174–181.

Singh, P. & Patel, R. M. (2016). Factors affecting in vitro degree of browning and culture establishment of pomegranate. *African Journal of Plant Science*, 10(2): 43–49.

Singh, T. P., Singh, R. K., & Malik, P. (2014). Analgesic and anti-inflammatory activities of *Annona squamosa* Linn bark. *Journal of Scientific and Innovative Research*, 3(1): 60–64.

Singh, N. V., Singh, S. K., & Patel, V. B. (2011). In vitro culture establishment studies on pomegranate. *Indian Journal of Horticulture*, 68(3): 307–311.

Šmelcerović, A., Tomović, K., Šmelcerović, Ž., Petronijević, Ž., Kocić, G., Tomašič, T., Jakopin, Ž., & Anderluh, M. (2017). Xanthine oxidase inhibitors beyond allopurinol and febuxostat; an overview and selection of potential leads based on in silico calculated physico-chemical properties, predicted pharmacokinetics and toxicity. *European Journal of Medicinal Chemistry*, 135: 491–516.

Spanova, M. & Daum, G. (2011). Squalene - biochemistry, molecular biology, process biotechnology, and applications. *European Journal of Lipid Science and Technology*, 113(11): 1299–1320.

Stank, A., Kokh, D. B., Fuller, J. C., & Wade, R. C. (2016). Protein binding pocket dynamics. *Accounts of Chemical Research*, 49(5): 809–815.

Starkey, E. S. & Sammons, H. M. (2015). Practical pharmacokinetics: what do you really need to know?. *Archives of Disease in Childhood*, 100(1): 37–43.

Stultz, C. M. & Karplus, M. (1999). MCSS functionality maps for a flexible protein. *Proteins*, 37(4): 512–529.

Sukweenadhi, J., Yunita, O., Setiawan, F., Kartini, Siagian, M. T., Danduri, A. P., & Avanti, C. (2020). Antioxidant activity screening of seven Indonesian herbal extract. *Biodiversitas*, 21(5): 2062–2067.

Sumarna, Y. (2002). *Budidaya Gaharu*. Penebar Swadaya, Depok.

Sumitha, A., Devi, P. B., Hari, S., & Dhanasekaran, R. (2020). Covid-19 – In silico structure prediction and molecular docking studies with doxycycline and quinine. *Biomedical & Pharmacology Journal*, 13(3): 1185–1193.

Sutomo, S. & Oktaviani, G. A. (2019). Eksplorasi lapangan jenis penghasil gaharu (*Gyrinops versteegii*) di Pulau Lombok Nusa Tenggara Barat. *ULIN: Jurnal Hutan Tropis*, 3: 64–69.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Syaban, M. F. R., Faratisha, I. F. D., Yunita, K. C., Erwan, N. E., Kuriniawan, B. D., & Putra, G. F. A. (2022). Molecular docking and interaction analysis of propolis compounds against SARS-CoV-2 receptor. *Journal of Tropical Life Science*, 12(2): 219–230.

Tang, W. & Newton, R. J. (2004). Increase of polyphenol oxidase and decrease of polyamines correlate with tissue browning in Virginia pine (*Pinus virginiana* Mill.). *Plant Science*, 167(3): 621–628.

Tobias, J. W., Shrader, T. E., Rocap, G., & Varshavsky, A. (1991). The N-end rule in bacteria. *Science*, 254(5036): 1374–1377.

Trichopoulou, A., Lagiou, P., Kuper, H., & Trichopoulos, D. (2000). Cancer and Mediterranean dietary traditions. *American Society of Preventive Oncology*, 9(9): 869–873.

Tsujimoto, M. (1916). A highly unsaturated hydrocarbon in shark liver oil. *The Journal of Industrial and Engineering Chemistry*, 8(10): 889–896.

Tung, Y. T., Chua, M. T., Wang, S. Y., & Chang, S. T. (2008). Anti-inflammation activities of essential oil and its constituents from indigenous cinnamon (*Cinnamomum osmophloeum*) twigs. *Bioresource Technology*, 99(9): 3908–3913.

United Nations. (2011). *Globally harmonized system of classification and labelling of chemicals (GHS)*. Part 3. Health hazards. Chapter 3.1. Acute toxicity. United Nations Publications. p. 109.

Verpoorte, R. (2000). Secondary Metabolism. In: Verpoorte, R. & Alfermann, A. W. (eds) *Metabolic Engineering of Plant Secondary Metabolism*. Kluwer Academic Publisher, Netherlands.

Vinholes, J., Gonçalves, P., Martel, F., Coimbra, M. A., & Rocha, S. M. (2014). Assessment of the antioxidant and antiproliferative effects of sesquiterpenic compounds in in vitro Caco-2 cell models. *Food Chemistry*, 156: 204–211.

Vijayasree, N. K., Udayasri, P., & Babu, R. (2010). Advancements in the production of secondary metabolites. *Journal of Natural Products*, 3: 112–123.

Wahyuni, D. K., Huda, A., Faizah, S., Purnobasuki, H., & Wardojo, B. P. E. (2020). Effects of light, sucrose concentration and repetitive subculture on callus growth and medically important production in *Justicia gendarussa* Burm.f. *Biotechnology Reports*, 27: e00473.

Walum E. (1998). Acute oral toxicity. *Environmental Health Perspectives*, 106 Suppl 2(Suppl 2): 497–503.

Wardana, T. A. P. (2019). *Identifikasi Senyawa Aktif Anti Kanker Ekstrak dan Fraksi Daun Gaharu (Gyrinops versteegii (Gilg.) Domke) dengan LC-MS dan GC-MS [Skripsi, Universitas Gadjah Mada]*.

UNIVERSITAS
GADJAH MADA
Elisitasi dan Profiling Terpenoid Kandidat Antioksidan pada Kalus Gyrinops versteegii (Gilg.) Domke dengan Asam Salisilat: Studi In Vitro dan In Silico
Sasangka Adhita Nugraha, Lisna Hidayati, S.Si., M.Biotech.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Wardana, T. A. P., Nuringtyas, T. R., Wijayanti, N., & Hidayati, L. (2019). Phytochemical analysis of agarwood (*Gyrinops versteegii* (Gilg.) Domke) leaves extracts as anticancer using GC-MS. *AIP Conference Proceedings*, 2194: 020136.

Xu, C. J., Sun, X. Z., Chen, D. Y., Lai, Y. Y., & Li, L. (2011). Cloning and characterization of peroxidase gene in *Phalaenopsis*. *Pakistan Journal of Botany*, 43(4): 2161–2167.

Yamaguchi, Y., Matsumura, T., Ichida, K., Okamoto, K., & Nishino, T. (2007). Human xanthine oxidase changes its substrate specificity to aldehyde oxidase type upon mutation of amino acid residues in the active site: roles of active site residues in binding and activation of purine substrate. *Journal of Biochemistry*, 141(4): 513–524.

Yuslianti, E. R. (2018). *Pengantar Radikal Bebas dan Antioksidan*. Deepublish Publisher, Yogyakarta.

Zheng, G. Q., Kenney, P. M., & Lam, L. K. (1992). Sesquiterpenes from clove (*Eugenia caryophyllata*) as potential anticarcinogenic agents. *Journal of Natural Products*, 55(7): 999–1003.