

Daftar Pustaka

- Al-Salahi, R. A., Al-Omar, M. A., Amr, A. E. G. E. 2010. Synthesis of chiral macrocyclic or linear pyridine carboxamides from pyridine-2, 6-dicarbonyl dichloride as antimicrobial agents. *Molecules*, 15(9), 6588-6597.
- Altaf, A. A., Shahzad, A., Gul, Z., Rasool, N., Badshah, A., Lal, B., Khan, E. 2015. A review on the medicinal importance of pyridine derivatives. *Journal of Drug Design and Medicinal Chemistry*, 1(1), 1-11.
- [Altschul, S. F.](#), [Gish, W.](#), [Miller, W.](#), [Myers, E.W.](#), [Lipman, D. J.](#) 1990. Basic local alignment search tool. *Journal of Molecular Biology* 215(3), 403-410.
- Asolkar, R. N., Schroder, D., Heckmann, R., Lang, S., Wagner-Dobler, I., Laatsch, H. 2004. Helquinoline, a new tetrahydroquinoline antibiotic from *Janibacter limosus* Hel 1. *Journal of Antibiotics (Tokyo)* 57, 17-23.
- Azman, A. S., Othman, I., Velu, S. S., Cha, K. G., Lee, L. H. 2015. Mangrove rare actinobacteria: taxonomy, natural compound, and discovery of bioactivity. *Front Microbiology* 6, 856. doi: 10.3389/fmicb.00856.
- Berdy, J. 2005. Bioactive microbial metabolites. *Journal of Antibiotics* 58, 1-26.
- Bisht, G. S., Bharti, A., Kumar, V., Gusain, O. 2013. Isolation, purification and partial characterization of an antifungal agent produced by salt-tolerant alkaliphilic *Streptomyces violascens* IN2-10. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences* 83(1), 109-117.
- Bister, B., Bischoff, D., Ströbele, M., Riedlinger, J., Reicke, A., Wolter, F., Bull, A. T., Zahner, H., Fiedler, H. P., Süßmuth, R. D. 2004. Abyssomicin C—A Polycyclic Antibiotic from a Marine *Verrucosispora* Strain as an Inhibitor of the p-Aminobenzoic Acid/Tetrahydrofolate Biosynthesis Pathway. *Angewandte Chemie International Edition* 43(19), 2574-2576.
- Bredholdt, H., Olga, A. G., Kerstin, E., Espen, F., Larissa, P. T., Sergey, B. Z. 2007. Rare actinomycete bacteria from shallow water sediments of the Trondheim fjord, Norway: isolation, diversity and biological activity. *Environment Microbiology* 9(11), 2756-2764.
- Blunt, J. W., Copp, B. R., Hu W. P., Munro, M. H., Northcote, P. T, Prinsep, M. R. 2007. Marine Natural Product. *Natural Product Rep.* 24, 31-86.
- Bull, A. T., Stach, J. E. M., Ward, A. C., Goodfellow, M. 2005. Marine actinobacteria: perspectives, challenges, future directions. *Antonie Van Leeuwenhoek* 87, 65-79.
- Bull, A. T., Ward, A. C., Goodfellow, M. 2000. Search and discovery strategies for biotechnology: the paradigm shift. *Microbiology and Molecular Biology Review* 64, 573-606.
- Butler, M. S. 2004. The role of natural product chemistry in drug discovery. *Journal of Natural Product* 67, 2141-2215.
- Chavan, V. P., Sonawane, S. A., Shingare, M. S., Karale, B. K. 2006. Synthesis, characterization, and biological activities of some 3, 5, 6-trichloropyridine derivatives. *Chemistry of Heterocyclic Compounds* 42(5), 625-630.
- Chen, P., Zhang, L., Guo, X., Dai, X., Liu, L., Xi, L., Wang, J., Song, L., Wang, Y., Zhu, Y., Huang, L., Huang, Y. 2016. Diversity, biogeografi, and

- biodegradation potential of actinobacteria in the deepsea sediment along the Southwest Indian Ridge. *Frontier Microbiology* 7, 1340. doi: 10.3389/fmicb.2016.01340.
- Cragg, G. M., Kingston, D. G. I., Newman, D. J. 2011. Development and Future Trend in Anticancer Natural Product Drug Discovery. In Cragg, G. M., Kingston, D. G. I., Newman, D. J. (Eds). *Anticancer Agents from Natural Products*. Taylor & Francis Group, LLC, Boca Rotan, US. p. 699-728.
- Cross, T. 1981. Aquatic actinomycetes: a critical survey of the occurrence, growth, and role of actinomycetes in aquatic habitats. *Journal of Applied Bacteriology* 50, 397-423.
- Dai, H. Q., Wang, J., Xin, Y. H., Pei, G., Tang, S. K., Ren, B., ... & Zhang, L. X. (2010). *Verrucosipora sediminis* sp. nov., a cyclodipeptide-producing actinomycete from deep-sea sediment. *International journal of systematic and evolutionary microbiology*, 60(8), 1807-1812.
- Felsenstein, J. 1985. Confident limits on phylogenies: an approach using the bootstrap. *Evolution* 39, 783-791.
- Fenical, W., Baden, D., Burg, M., de Goyet, C. V., Grimes, J. D., Katz, M., Marcus, N. H., Pomponi, S., Rhines, P., Tester, P., Vena, J. 1999. Marine-derived pharmaceuticals and related bioactive compounds. In *From Monsoons to Microbes : Understanding the Ocean's Role in Human Health*. Edited by Fenical W. National Academies Press. p. 71-86.
- Fiedler, H. P., Bruntner, C., Bull, A. T., Ward, A. C., Goodfellow, M., Potterat, O., Puder, C., Mihm, G. 2005. Marine actinomycetes as a source of novel secondary metabolites. *Antonie Van Leeuwenhoek* 87, 37-42.
- Fiedler, H. P., Bruntner, C., Riedlinger, J., Bull, A. T., Knutsen, G., Goodfellow, M., Jones, A., Maldonado, L., Pathom-Aree, W., Beil, W., Schneider, K. 2008. Proximicin A, B and C, novel aminofuran antibiotic and anticancer compounds isolated from marine strains of the actinomycete *Verrucosipora*. *The Journal of Antibiotics*, 61(3), 158.
- Franco-Correa, M., Quintana, A., Duque, C., Suarez, C., Rodríguez, M. X., & Barea, J. M. (2010). Evaluation of actinomycete strains for key traits related with plant growth promotion and mycorrhiza helping activities. *Applied soil ecology*, 45(3), 209-217.
- Gao, X., Lu, Y., Xing, Y., Ma, Y., Lu, J., Bao, W. 2012. A novel anticancer and antifungus phenazine derivate from a marine actinomycete BM-17. *Microbiology Research* 167, 616-622.
- Gartner, A., Jutta, W., Johannes, F. I. 2016. Diversity of *Micromonospora* strains from the deep Mediterranean Sea and their potential to produce bioactive compounds. *AIMS Microbiology* 2(2), 205-221.
- Goodfellow, M., Haynes, J. A. 1984b. Actinomycetes in marine sediments. In Ortiz-ortiz, L., Bojalil, L. F., Yakoleff, V. (ed.) *Biological, biochemical, and biomedical aspects of actinomycetes*. Academic Press, Inc., New York, N.Y. pp. 453-472.
- Hart, H., Craine, L.E., & Hart, D.J. 2003. *Organic Chemistry : A Short Course* (11th edition). Houghton Mifflin Company, USA.

- Hutabarat, S., & Evans, S. M. 1985. *Pengantar oseanografi*. Penerbit Universitas Indonesia (UI-Press).
- Kamjam, M., Sivalingam, P., Deng, Z., Hong, K. 2017. Deepsea actinomycetes and their secondary metabolites. *Frontiers in Microbiology* 8, 760. doi: 10.3389/fmicb.2017.00760
- Kanoh, K., Adachi, K., Katsuta, A., & Shizuri, Y. 2008. Structural Determination and Proposed Biosynthesis of Alcanivorone, a Novel α -Pyrone Produced by *Alcanivorax jadensis*. *The Journal of antibiotics*, 61(2), 70.
- Khan, S. T., Komaki, H., Motohashi, H., Kozone, I., Takagi, M., Kazuo, S. 2011. *Streptomyces* associated with marine sponge *Haliclona* sp.: biosynthetic genes for secondary metabolites and products. *Environments Microbiology* 13, 391-403.
- Haefner, B. 2003. Drug from deep: marine natural products as drug candidates. *Drug Discovery Today* 9, 536-544.
- Hamada, M., Shibata, C., Tamura, T., Suzuki, K. 2013. *Zhihengliuella flava* sp. nov., an actinobacterium isolated from sea sediment, and emended description of the genus *Zhihengliuella*. *International Journal of Systematics and Evolutionary Microbiology* 63, 4760-4764.
- Hamada, M., Shibata, C., Nurkanto, A., Ratnakomala, S., Lisdiyanti, P., Tamura, T., Suzuki, K. 2015a. *Tropicihabitans flavus* gen. nov., sp. nov., a new member of the family *Cellulomonadaceae*. *Antonie van Leeuwenhoek* 107, 1299-1306.
- Hamada, M., Shibata, C., Nurkanto, A., Ratnakomala, S., Lisdiyanti, P., Tamura, T., Suzuki, K. 2015b. *Serinibacter tropicus* sp. nov., an actinobacterium isolated from the rhizosphere of a mangrove, and emended description of the genus *Serinibacter*. *International Journal of Systematics and Evolutionary Microbiology* 65, 1151-1154.
- Hamaki, T., Suzuki, M., Fudou, R., Jojima, Y., Kajiura, T., Tabuchi, A. 2005. Isolation of novel bacteria and actinomycetes using soil-extract agar medium. *Journal of Bioscience and Bioengineering* 99, 485-492.
- Hayakawa, M., Nonomura, H. 1987. Humic-Acid Vitamin Agar, a new medium for selective isolation of soil actinomycetes. *Journal of Fermentation Technology* 65, 501-509.
- Hayakawa, M., Sadakata, T., Kajiura, T., Nonomura, H. 1991. New methods for the highly selective isolation of Micromonospora and Microbispora from soil. *Journal of Fermentation and Bioengineering* 72(5), 320-326.
- Hayakawa, M., Momose, Y., Yamazaki, T., Nonomura, H., 1996. A method for the selective isolation of *Microtetraspora glauca* and related four-spored actinomycetes from soil. *Applied Microbiology* 80(4), 375-386. <https://doi.org/10.1111/j.1365-2672.1996.tb03232.x>
- Hayakawa, M., Nonomura, H. 1989. A new method for the intensive isolation of actinomycetes from soil. *Actinomycetologica* 3(2), 95-104.
- Hayakawa, M., Takeuchi, T., Yamazaki, T. 1996. Combined use of trimethoprim with nalidixic acid for the selective isolation and enumeration of actinomycetes from soil. *Actinomycetologica* 10(2), 80-90.

- Hayakawa, M., Otaguro, M., Takeuchi, T., Yamazaki, T., Iimura, Y. 2000. Application of a method incorporating differential centrifugation for selective isolation of motile actinomycetes in soil and plant litter. *Antonie van Leeuwenhoek* 78(2), 171-185.
- Helaly, S. E., Pesic, A., Fiedler, H. P., Sussmuth, R. D. 2011. Elaiomycins B and C: Alkylhydrazide antibiotics from *Streptomyces* sp. BK 190. *Org Letter* 13, 1052-1055.
- Helmke, E., Weyland, H. 1984. *Rhodococcus marinonascens* sp. nov., an actinomycete from the sea. *International Journal of Systematics Bacteriology* 34, 127-138.
- Hong, K. 2013. Actinomycetes from mangrove and their secondary metabolites. *Acta Microbiology Sin* 53, 1131-1141.
- Hong, K., Gao, A. H., Xie, Q., Gao, H., Zhuang, L., Lin, H. P., Yu, H. P., Li, J., Yao, X. S., Goodfellow, M., Ruan, J. S. 2009. Actinomycetes for marine drug discovery isolated from mangrove soils and plants in China. *Marine Drugs* 7, 24-44. doi: 10.3390/md7010024.
- Hong, S. G., Lee, Y. K., Yim, J. H., Chun, J., Lee, H. K. 2008. *Sanguibacter antarcticus* sp nov., isolated from Antarctic sea sand. *International Journal of Systematics and Evolutionary Microbiology* 58, 50-52. doi: 10.1099/ijs.0.60531-0.
- Huang, P., Xie, F., Ren, B., Wang, Q. Wang, J., Wang, Q. Abdel-Mageed, W. M., Liu, M., Han, J., Oyeleye, A., Shen, J. 2016. Anti-MRSA and anti-TB metabolites from marine-derived *Verrucosipora* sp. MS100047. *Applied Microbiology and Biotechnology* 100(17), 7437-7447.
- Imada, C. Koseki, N., Kamata, M., Kobayashi, T., Hamada-Sato, N. 2007. Isolation and characterization of antibacterial substances produced by marine actinomycetes in the presence of seawater. *Actinomycetologica* 21, 27-31.
- Inagaki, F., Suzuki, M., Takai, K., Oida, H., Sakarnoo, T., Aoki, K., Nealson, K. H., Horikoshi, K. 2003. Microbial community associated with geological horizons in coastal sub-seafloor sediments from the sea of Okhotsk. *Applied Environmental Microbiology* 69, 7224-7235.
- Jensen, P. R., Mincer, T. J., Williams, P. G., Fenical, W. 2005. Marine actinomycete diversity and natural product discovery. *Antonie Van Leeuwenhoek* 87, 43-48.
- Jensen, P. R., Dwight, R., Fenical, W. 1991. Distribution of actinomycetes in near-shore tropical marine sediments. *Applied Environmental Microbiology* 57, 1102-1108.
- Kawamoto, I. 1989. Genus *Micromonospora* Ørskov 1923, 147AL. In *Bergey's Manual of Systematic Bacteriology*, vol. 4. Williams, S. T., Sharpe, M. E., Holt, J. G. (Eds). Baltimore: Williams & Wilkins. p. 2442-2450.
- Kamjam, M., Sivalingam, P., Deng, Z., Hong, K. 2017. Deep sea actinomycetes and their secondary metabolites. *Frontiers in Microbiology* 8, 760. doi: 10.3389/fmicb.2017.00760.
- Khan, S. T., Komaki, H., Motohashi, H., Kozone, I., Takagi, M., Kazuo, S. 2011. *Streptomyces* associated with marine sponge *Haliclona* sp.: biosynthetic

- genes for secondary metabolites and products. *Environment Microbiology* 13, 391-403.
- Kim, T. K., Garson, M. J., Fuerst, J. A. 2005. Marine actinomycetales related to the 'Salinispora' group from the Great Barrier Reef sponge *Pseudoceratina clavata*. *Environment Microbiology* 7, 509-518.
- Kimura, M. 1980. A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16, 111-120.
- Kirby, B. M., Meyers, P. R. 2010. *Micromonospora tulbaghia* sp. nov., isolated from the leaves of wild garlic, *Tulbaghia violacea*. *International Journal of Systematic and Evolutionary Microbiology* 60(6), 1328-1333.
- Kittiwongwattana, C., Thanaboripat, D., Laosinwattana, C., Koohakan, P., Parinthawong, N., Thawai, C. 2015. *Micromonospora oryzae* sp. nov., isolated from roots of upland rice. *International Journal of Systematic and Evolutionary Microbiology* 65, 3818-3823.
- Kumar, S., Tamura, K., Nei, M. 2004. MEGA3: integrated software for molecular evolutionary genetics analysis and sequence alignment. *Brief Bioinformatics* 5, 150-163
- Kuncharoen, N, Pittayakhajonwut, P., Tanasupawat, S. 2018. *Micromonospora globbae* sp. nov., an endophytic actinomycete isolated from roots of *Globba winitii* C. H. Wright. [*International Journal of Systematic and Evolutionary Microbiology* 68\(4\), 1-5. DOI 10.1099/ijsem.0.002625](#)
- Kwon, H. C., Kauffman, C. A., Jensen, P. R., Fenical, W. 2006. Marinomycins a-d, antitumor antibiotics of new structure class from a marine actinomycete of the recently discovered genus 'Marinispora'. *Journal of American Chemistry Society* 128, 1622-1632.
- Kyeremeh, K., Acquah, K. S., Camas, M., Tabudravu, J., Houssen, W., Deng, H., Jaspars, M. 2014. Butrepyrazinone, a New Pyrazinone with an Unusual Methylation Pattern from a Ghanaian *Verrucospora* sp. K51G. *Marine Drugs* 12(10), 5197-5208.
- Lam, K. S. 2006. Discovery of novel metabolites from marine actinomycetes. *Current Opinion Microbiology* 9, 245-251.
- Lee, C. R., Ill, H. C., Byeong, C. J., Sang, H. L. 2013. Strategies to minimize antibiotics resistance. *Int. J. Environ. Res. Public Health* 10, 4274-4305.
- Li, S., Tian, X., Niu, S., Zhang, W., Chen, Y., Zhang, H. 2011. Pseudonocardians AC, new Diazanthraquinone derivates from a deep sea actinomycete *Pseudonocardia* sp. SCSIO 01299. *Marine Drugs* 9, 1428-1439. doi: 10.3390/md9081428.
- Lisdiyanti, P., Otoguro, M., Ratnakomala, S., Lestari, Y., Hastuti, R. D., Triana, E., Ando, K., Widyastuti, Y. 2010. *Actinokineospora baliensis* sp. nov., *Actinokineospora cibodasensis* sp. nov. and *Actinokineospora cianjurenensis* sp. nov., isolated from soil and plant litter. *International Journal of Systematic and Evolutionary Microbiology*, 60(10), 2331-2335.
- Lisdiyanti, P., Tamura, T., Ratnakomala, S., Ridwan, R., Kartina, G., Lestari, Y., Ando, K., Widyastuti, Y. 2012. Diversity of actinomycetes from soil

- samples collected from Lombok Island, Indonesia. *Annales Bogorienses* 16(1), 35-40.
- Lu, J., Ma, Y., Liang, J., Xing, Y., Xi, T., & Lu, Y. 2012. Aureolic acids from a marine-derived *Streptomyces* sp. WBF16. *Microbiological research*, 167(10), 590-595.
- Luedemann, G. M., Casmer, C. J. 1973. Electron microscope study of whole mounts and thin sections of *Micromonospora chalcea* ATCC 12452. *International Journal of Systematic and Evolutionary Microbiology*, 23(3), 243-255.
- Luo, Y., Cobb, R. E., Zhao, H. 2014. Recent advances in natural product discovery. *Current Opinion in Biotechnology* 30, 230-237.
- Luo, Y., Jing, X., Yin, W., Jing, X., Shujie, X., Jun, X. 2011. *Streptomyces indicus* sp nov., an actinomycete isolated from deep-sea sediment. *International Journal of Systematics and Evolutionary Microbiology* 61, 2712-2716.
- Magarvey, N. A., Keller, J. M., Bernan, V., Dworkin, M., Sherman, D. H. 2004. Isolation and characterization of novel marine-derived actinomycete taxa rich in bioactive metabolites. *Applied Environment Microbiology* 70, 7520-7529.
- Maldonado, L. A., Stach, J. E. M., Pathom-aree, W., Ward, A. C., Bull, A. T., Goodfellow, M. 2005a. Diversity of cultivable actinobacteria in geographically widespread marine sedimen. *Antonie van Leeuwenhoek* 87, 11-18.
- Maldonado, L. A., Fenical, W., Jensen, P. R., Kauffman, C. A., Mincer, T. J., Ward, A. C., Bull, A. T., Goodfellow, M. 2005b. *Salinispora aranicola* gen. nov., sp.nov. and *Salinispora tropica* sp.nov., obligate marine actinomycetes belonging to the family *Micromonosporaceae*. *International Journal of Systematics and Evolutionary Microbiology* 55, 1759-1766.
- Mann, J. 2001. Natural products as immunosuppressive agents. *Natural Product Reports* 18, 417-430.
- Manivasagan, P., Jayachandran V., Kannan S., and Se-Kwon, K. 2013. Marine actinobacterial metabolites: Current status and Future perspective. *Microbiological Research* 168, 311-332.
- Manivasagan, P., Jayachandran, V., Kannan, S., Se-Kwon, K. 2014. Pharmaceutically active secondary metabolites of marine actinobacteria. *Microbiological Research* 169, 262-278.
- Mincer, T. J., Paul, R. J., Christopher, A. K., William, F. 2002. Widespread and persistent population of a major new marine actinomycete taxon in ocean sediments. *Applied and Environment Microbiol.* 68:5005-5011.
- Mincer, T.J., Fenical, W., Jensen, P.R., 2005. Culture dependent and culture independent diversity within the obligate marine actinomycete genus *Salinispora*. *Appl Environ Microbiol* 71:7019-7028.
- Moran, M. A., Rutherford, L.T. Hodson, R.E. 1995. Evidence for indigenous *Streptomyces* populations in marine environment determined with a 16S rRNA probe. *Appl. Environ. Microbiology* 61, 3695-3700.

- Murniasih, T., & Bayu, A. (2016). Carbon Source Optimization for Antibiotic Production from Aaptos-Associated Bacteria Rhodobacteracea bacterium SP. 2.11. *Marine Research in Indonesia*, 40(2), 79-84.
- Naik, T. A., Chikhalia, K. H. 2007. Studies on synthesis of pyrimidine derivatives and their pharmacological evaluation. *Journal of Chemistry* 4(1), 60-66.
- Nybakken, J. W. 1988. *Biologi Laut: Suatu Pendekatan Ekologis*. PT. Gramedia, Jakarta. 580 pp.
- Oldfield, C., Wood, N. T., Gilbert, S. C., Murray, F. D., Faure, F. R. 1998. Desulphurisation of benzothiophene and dibenzothiophene by actinomycete organisms belonging to the genus Rhodococcus, and related taxa. *Antonie Van Leeuwenhoek* 74, 119-132.
- Orskov J. 1923. Investigations into the Morphology of the Ray Fungi. *Copenhagen: Levin and Munksgaard*. 174 pp.
- Pan, H. Q., Yu, S. Y., Song, C. F., Wang, N., Hua, H. M., Hu, J. C., Wang, S. J. 2015. Identification and characterization of the antifungal substances of a novel *Streptomyces cavourensis* NA4. *Journal of Indian Microbiology and Biotechnology* 25, 353-357. doi: 10.4014/jmb.1407.07025.
- Pan, H. Q., Zhang, S. Y., Wang, N., Li, Z. I., Hua, H. M., Hu, J. C., Wang, S. J. 2013. New spirotetronate antibiotics Iobophorins H and I from a South China sea derived *Streptomyces* sp. 12A35. *Marine Drugs* 11, 3891-3901. doi: 10.3390/md11103891
- Patantis, G., Chanasah, E., Zilda, D. S., Waluyo, I. B. 2012. Bacterial diversity of the deep sea of Sangihe Talaud Sulawesi. *Squalen* 7(1), 19-27.
- Pathom-aree, W., James, E. M., Stach, A. C. W., Horikoshi, K., Bull, A. T., Goodfellow, M. 2006. Diversity of actinomycetes isolated from Challenger Deep sediment (10,898 m) from Mariana Trench. *Extremophiles* 10, 181-189.
- Pecznska-Czoch, W., Mordarski, M. 1988. Actinomycete enzymes. In *Actinomycetes in Biotechnology*. Edited by Goodfellow, M., Williams, S. T., Mordarski, M. London: Academic Press; p. 219-283.
- Pesic, A., Baumann, H. I., Kleinschmidt, K., Ensle, P., Wiese, J., Süßmuth, R. D., Imhoff, J. F. 2013. Champacyclin, a new cyclic octapeptide from *Streptomyces* strain C42 isolated from the Baltic Sea. *Marine Drugs* 11(12), 4834-4857.
- Phongsopitanun, W., Kudo, T., Mori, M., Shiomi, K., Pittayakhajonwut, P., Suwanborirux, K., Tanasupawat, S. 2015. *Micromonospora fluostatini* sp. nov., isolated from marine sediment. *International Journal of Systematic and Evolutionary Microbiology*, 65(12), 4417-4423.
- Pine, S.H., Hendrickson, J.B., & Cram, D.J. 1980. Organic Chemistry (4th edition). McGraw-Hill, Inc.
- Pringgenies, D. 2010. Karakteristik Senyawa Bioaktif Bakteri Simbion Moluska dengan GCMS. *Jurnal Ilmu dan Teknologi Kelautan Tropis* 2(2), 34-40, IPB, Bogor.
- Ramesh, S., Rajesh, M., Mathivanan, N. 2009. Characterization of a thermostable alkaline protease produce by marine *Streptomyces fungicidicus* MML 1614. *Bioprocess Biosystematic and Engineering* 32, 791-800.

- Ratnakomala, S., Lisdiyanti, P., Widyastuti, Y. 2016a. Collection of Indonesian Actinomycetes and its Uses. *In Exploring Indonesian Microbial Genetic Resources for Industrial Application*. Sukara, E., Lisdiyanti, P. (eds). LIPI Press pp. 177-204.
- Ratnakomala, S., Apriliana, P., Fahrurrozi, F., Lisdiyanti, P., Kusharyoto, W. 2016b. Aktivitas Antibakteri Aktinomisetes Laut Dari Pulau Enggano [Antibacterial Activity of Marine Actinomycetes From Enggano Island]. *Berita Biologi* 15(3), 275-283
- Rheims, H., Schumann, P., Rohde, M., Stackebrandt, E. 1998. *Verrucosipora gifhornensis* gen. nov., sp. nov., a new member of the actinobacterial family Micromonosporaceae. *International Journal of Systematic and Evolutionary Microbiology* 48(4), 1119-1127.
- Riedlinger, J., Reicke, A., Zahner, H., Krismer, B., Bull, A. T., Maldonado, L. A., Ward, A. C., Goodfellow, M., Bister, B., Bischoff, D., Sussmuth, R. D., Fiedler, H. P. 2004. Abyssomicins, inhibitors of the para-aminobenzoic acid pathway produce by the marine *Verrucosipora* strain AB-18-032. *Journal of Antibiotic (Tokyo)* 57, 271-279.
- Sabet, R., Fassihi, A., Moeinifard, B. 2009. Preliminary MLR studies of antimicrobial activity of some 3-hydroxypyridine-4-one and 3-hydroxypyran-4-one derivatives. *Research in Pharmaceutical Sciences* 2(2), 103-112.
- Saitou, H., Nei, M. 1987. The neighbour-joining method : a new method for reconstructing *phylogenetic trees*. *Molecular Biology and Evolution* 4, 406-425.
- Savchenko, V. I., Dorokhov, V. G., Yakushchenko, I. K., Zyuzin, I. N., Aldoshin, S. M. 2010. Developing state-of-the-art antiseptics based on pyridine derivatives. *Herald of the Russian Academy of Sciences* 80(2), 149-154.
- Shirai, M., Okuda, M., Motohashi, K., Imoto, M., Furihata, K., Matsuo, Y., Katsuta, A., Shizuri, Y., Seto, H. 2010. Terpenoids produced by actinomycetes: isolation, structural elucidation and biosynthesis of new diterpenes, gifhornenolones A and B from *Verrucosipora gifhornensis* YM28-088. *Journal of Antibiotics* 63(5), 245-250.
- Silverstein, R.M., Bassler, G.C., & Morrill, T.C. 1991. Spectrofotometric Identification of Organic Compound (4th edition). John Wiley & Sons, New York.
- Skropeta, D. Wei, L. 2014. Recent advances in deepsea natural product. *Natural Product Reports* 31, 999-1025. doi: 10.1039/C3NP70118B.
- Schneider, K., Keller, S., Wolter, F. E., Ro'glin, L., Beil, W., Seitz, O., Nicholson, G., Bruntner, C., Riedlinger, J., Fiedler, H. P., Sussmuth, R. D. 2008. Proximicins A, B, and C-antitumor furan analogues of netropsin from the marine actinomycetes *Verrucosipora* induce upregulation of p53 and the cyclin kinase inhibitor p21. *Angewandte Chemie International Edition* 47(17), 3258-3261.
- Song, Y., Li, Q., Liu, X., Chen, Y., Zhang, Y., Sun, A., Zhang, W., Zhang, J., Ju, J. 2014. Cyclic hexapeptides from the deep South China sea derived *Streptomyces scopuliridis* SCSIO ZJ46 active against pathogenic gram

- positive bacteria. *Journal of Natural Product* 77, 1937-1941. doi: 10.1021/np500399v
- Song, Y., Liu, G., Li, J., Huang, H., Zhang, X., Zhang, H., Ju, J. 2015. Cytotoxic and antibacterial Angucycline- and Prodigiosin- analogues from the deep sea derived *Streptomyces* sp. SCSIO 11594. *Marine Drugs* 13, 1304-1316. doi: 10.3390/md13031304.
- Soebagio. 2002. Kimia Analitik II. Malang. Universitas Negeri Malang.
- Stach, J. E. M., Maldonado, L. A., Ward, A. C., Goodfellow, M., Bull, A. T. 2003a. New primers for the class Actinobacteria: application to marine and terrestrial environments. *Environment Microbiology* 5, 828-841.
- Stach, J. E., Maldonado, L. A., Masson, D. G., Ward, A. C., Goodfellow, M., Bull, A. T. 2003b. Statistical approaches to estimating bacterial diversity in marine sediments. *Applied of Environment Microbiology* 69, 6189-6200.
- Stackebrandt, E., Koch, C., Gvozdiak, O., Schumann, P. 1995. Taxonomic Dissection of the Genus *Micrococcus*: *Kocuria* gen. nov., *Nesterenkonia* gen. nov., *Kytococcus* gen. nov., *Dermaococcus* gen. nov., and *Micrococcus* Cohn 1872 gen. emend. *International Journal of Systematic and Evolutionary Microbiology* 45(4), 682-692.
- Stackebrandt, E., Rainey, F.A., and Ward-Rainey, N.L. 1997. Proposal for a new hierarchic classification system, *Actinobacteria* classis nov. *International Journal of Systematics and Evolutionary Microbiology* 47, 479-491.
- Strohl, W. R. 2004. Antimicrobials. In *Microbial Diversity and Bioprospecting*. Edited by Bull A. T. ASM Press p. 336-355.
- Suarez, J. E., Hardisson, C. 1985. Morphological characteristics of colony development in *Micromonospora chalcea*. *Journal of Bacteriology*, 162(3), 1342-1344.
- Supong, K., Suriyachadkun, C., Pittayakhajonwut, P., Suwanborirux, K., Thawai, C. 2013. *Micromonospora spongicola* sp. nov., an actinomycete isolated from a marine sponge in the Gulf of Thailand. *Journal of Antibiotics* 66, 505-509.
- Tanasupawat, S., Jongrungruangchok, S., Kudo, T. 2010. *Micromonospora marina* sp. nov., isolated from sea sand. *International Journal of Systematics and Evolutionary Microbiology* 60, 648-652.
- Thawai, C. 2015. *Micromonospora costi* sp. nov., isolated from a leaf of *Costus speciosus*. *Int International Journal of Systematics and Evolutionary Microbiology* 65, 1456-1461.
- Thompson, J. D., Higgins, D. G., Gibson, T. J. 1994. CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acid Research* 22, 4673-4680.
- Trujillo, M. E., Kroppenstedt, R. M., Schumann, P., Carro, L., Martínez Molina, E. 2006. *Micromonospora coriariae* sp. nov., isolated from root nodules of *Coriaria myrtifolia*. *International Journal of Systematics and Evolutionary Microbiology* 56, 2381-2385.

- Valli, S., Suvathi, S. S., Aysha, O. S, Nirmala, P., Vinoth, K. P, Reena, A. 2012. Antimicrobial potential of *Actinomycetes* species isolated from marine environment. *Asian Pacific Journal of Tropical Biomedicine* 2(6), 469-473.
- Wagman, G. H., Weinstein, M. J. 1980. Antibiotic from Micromonospora. *Annual Review on Microbiology* 34, 537-557.
- Wang, Q., Song, F., Xiao, X., Huang, P., Li, L., Monte, A., Abdel-Mageed, W. M, Wang, J., Guo, H., He, W., Xie, F., Dai, H., Liu, M., Chen, C., Xu, H., Liu, M., Piggott, A. M., Liu, X., Capon, R. J., Zhang, L. 2013. Abyssomicins from the South China Sea Deep-Sea Sediment *Verrucosispora* sp.: Natural Thioether Michael Addition Adducts as Antitubercular Prodrugs. *Angewandte Chemie International Edition* 52(4), 1231-1234.
- Watve, M. G., Tickoo, R., Jog, M. M., Bhole, B. D. 2001. How many antibiotics are produce by genus *Streptomyces*? *Arch Microbiology* 176(5), 386-390.
- Widawati, S., Suliasih, S., Latupapua, H., Sugiharto, A. 2005. Biodiversity of Soil Microbes from Rhizosphere at Wamena Biological Garden (WBiG), Jayawijaya, Papua. *Biodiversitas Journal of Biological Diversity* 6(1), 6-11.
- Widianwari, P. 2013. Kelimpahan, Keragaman, dan Distribusi Vertikal Makrobenthos Laut Jeluk Selat Makassar. Laporan Akhir. Pusat Penelitian Oseanografi-LIPI, Jakarta.
- Weyland, H. 1969. Actinomycetes in North Sea and Atlantic Ocean sediments. *Nature* 223, 858.
- Weyland, H. 1981. Distribution of actinomycetes on the sea floor. *Zentralbl Bacteriology Supplement* 11, 185-193.
- Williams, S. T., Lanning, S., Wellington, E. M. H. 1984. Ecology of actinomycetes. In *The biology of actinomycetes*. Goodfellow, M. Mordarski, Williams, S. T. (ed.). Academic Press, London. UK. p. 481-528.
- Wyche, T. P., Hou, Y., Braun, D., Cohen, H. C., Xiong, M. P., Bugni, T. S. 2011. First natural analogs of the cytotoxic thiodepsipeptide thiocoraline A from a marine *Verrucosispora* sp. *Journal of Organic Chemistry* 76(16), 6542-6547.
- Xu, D. B., Ye, W. W., Han, Y., Deng, Z. X., Hong, K. 2014. Natural product of marine actinomycetes. *Marine Drugs* 12, 2590-2613. doi: 10.3390/md12052590.
- Yang, X. W., Zhang, G. Y., Ying, J. X., Yang, B., Zhou, X. F., Steinmetz, A., Liu, Y. H., Wang, N. 2013. Isolation, characterization, and bioactivity evaluation of 3-((6-methylpyrazin-2-yl)methyl)-1H-indole, a new alkaloid from a deep sea derived actinomycete *Serinicoccus profundus* sp. nov. *Marine Drugs* 11, 33-39. doi: 10.3390/md11010033
- Yu, J., Zhang, L., Liu, Q., Qi, X. H., Ji, Y., Kim, B. S. 2015. Isolation and characterization of actinobacteria from Yalujiang coastal wetland, North Cina. *Asian Pacific Journal of Tropical Biomedicine* 5, 555-560. doi: 10.1016/j.apjtb.2015.04.007.

- Zav'yalova, V. K., Zubarev, A. A., Shestopalov, A. M. 2009. Synthesis and reactions of 3-acetyl-6-methyl-2-(methylthio) pyridine. *Russian Chemical Bulletin* 58(9), 1939-1944.
- Zhang, L., Xi, L., Ruan, J., Huang, Y. 2012. *Microbacterium marinum* sp. nov., isolated from deepsea water. *Systematics of Applied Microbiology* 35, 81-85. doi: 10.1016/syapm.2011.11.004.
- Zhang, G., Zhang, Y., Yin, X., Wang, S. 2015. *Nesterenkonia alkaliphila* sp. nov., an alkaliphilic, halotolerant actinobacteria from the western Pacific Ocean. *International Journal of Systematics and Evolutionary Microbiology* 65, 516-521. doi: 10.1099/ijs.0.065623-0.
- Zhao, G. Z., Li, J., Qin, S., Zhang, Y. Q., Zhu, W. Y., Jiang, C. L., Xu, L. H., Li, W. J. 2009. *Micrococcus yunnanensis* sp. nov., a novel actinobacterium isolated from surface-sterilized *Polyspora axillaris* roots. *International Journal of Systematics and Evolutionary Microbiology* 59(10), 2383-2387.
- Zhao J, Guo, L., Liu, C., Zhang, Y., Guan, X., Li, J., Xu, S., Xiang, W., Wang, X. 2016. *Micromonospora lycii* sp. nov., a novel endophytic actinomycete isolated from wolfberry root (*Lycium chinense* Mill). *Journal of Antibiotics* 69, 153-158.
- ZoBell, C. E., Upham, H. C. 1944. A list of marine bacteria including descriptions of sixty new species. *Bulletin Scripps Institute of Oceanography California* 5, 239-292.