

BAB 5

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Kesimpulan yang dapat diambil dari penelitian ini adalah

1. Terdapat 4 fungi endofit yang dapat diisolasi dari daun tanaman Cabai Merah (*Capsicum annuum L.*)
2. Isolat memiliki karakter yang diduga sama dengan genus *Aspergillus*, *Fusarium* dan *Chaetosphaeria*.
3. Isolat MEA R3 (*Fusarium*) memiliki aktivitas enzim L-asparaginase dengan indeks aktivitas enzim sebesar 2,14.

5.2 Saran

Sebaiknya dilakukan penelitian lebih lanjut tentang purifikasi dan karakterisasi enzim L-asparaginase yang dihasilkan oleh fungi edofit dari daun tanaman Cabai Merah agar bisa dijadikan sumber alternatif penghasil L-asparaginase untuk terapi *Acute Lymphoblastic Leukemia* (ALL).

DAFTAR PUSTAKA

- Bacon, C.W. and White, J.F. 2000, *Microbial Endophytes*, New York (US), Marcel Dekker.
- Baskar, G. and Kumar, D. 2009, Optimization of carbon nitrogen sources for L-asparaginase production by *Enterobacter aerogenes* using response surfaemethodology. *Chem. Biochem. Eng.* **23**: 393-397.
- Baskar, G. and Renganathan B. 2011, Optimization of media components and operating condition for exogenous production of fungal L-asparaginase, *Chiang Mai J. Sci.* **38**: 270-279.
- Blank, I., Goldmann, R.F., Varga, N., Devand, S., Saucy, F. and Huuynh, T. 2015, Mechanism of acrylamide formation: Maillard induced transformation of asparagine. *Adv.Exp.Med.Biol.* **561**: 171.
- Chmielewska, E.W. and Michałojć, Z. 2009, Anatomical features of leaves of sweet pepper (*capsicum annuum* L.) fed with calcium using foliar nutrition. *Acta Agrobotanica* **62 (2)**: 155–164.
- Clay, K. 2004, Fungi and the food of the gods, *Nature*, **427**: 401-402.
- Deacon, J.W. 2005, *Fungal biology*, 4th edition.
- Djarwaningsih, T. 1986. Jenis-jenis *Capsicum* L. (Solanaceae) di Indonesia, *Berita Biologi* **3(5)**: 225-228.
- Ezra, D., Hess, W.M. and Strobel G.A. 2004, New endophytic isolates of *Muscodor albus*: a volatile-antibiotic-producing fungus, *Microbiology*, **150**: 4023-4031.
- Fuhr, U., Boettcher, M.I. and Schippers, M. 2006, Toxicokinetics of Acrylamide in Humans After Ingestion of a Defined Dose in a Test Meal To Improve Risk Assessment forAcrylamide Carcinogenicity, *Cancer Epidemiology Biomarkers and Preention*, **15(2)**: 266-271.
- Gulati, R., Saaxena, R.K. and Gupta, R. 1996, A rapid plate assay for screening L-asparaginase producing microorganisms, *Letter in Applied Microbiology*, **24**: 23-26.
- Harper, J.K., Arif, A.M. and Ford E.J. 2003, Pestacin: a 1,3-dihydro isobenzofuran from *Pestalotiopsis microspora* possessing antioxidant and antimycotic activities, *Tetrahedron*, **59(14)**: 2471-2476.
- Heiser, C.B. and Pickersgill, B. 1969, Names for the cultivated *Capsicum* species (Solanaceae), *Taxon*, **18**: 277-283.

- Hewindati, Yuni Tri dkk. 2006, *Hortikultura*, Universitas Terbuka, Jakarta.
- Hung, P. Q. dan Annapurna, K. 2004, Isolation and characterization of endophytic bacteria in soybean (*Glycine sp.*), *Omonrice*, **12**: 92-101.
- Karomah, L. 2015, ‘Karakterisasi L-asparaginase kapang endofit kentang (*Solanum tuberosum L.*) pada medium soybean meal’, *Skripsi*, Sarjana Biologi, Universitas Jember.
- Kidd, J.G. 1953, Regression of transplanted lymphomas induced in vivo by means of normal guinea pig serum: Course of transplanted cancers of various kinds in mice and rats given guinea pig serum, horse serum or rabbit serum, *J Exp Med*, **3**: 565-582.
- Kumala, S. 2014, *Mikroba Endofit, Pemanfaatan Mikroba Endofit dalam Bidang Farmasi*, ISFI Penerbitan, Jakarta.
- Kumar, D.A. and Sobha K. 2012, A comprehensive review: L-asparaginase from microbes, *ABR* **3(4)**: 137-157.
- Liu, Q., Parsons, Xue, A.J., Fraser, H., Ryan, K., Newman, G.D. and Rasmussen, S. 2011, Competition between foliar *Neotyphodium lolii* endophytes and mycorrhizal *Glomus* spp. fungi in *Lolium perenne* depends on resource supply and host carbohydrate content, *Functional Ecology*, **25**: 910-920.
- Miller, R., Miller, C.M., Kinney, D.G., Redgrave, B., Sears, J. and Strobel, A. 1998, Ecomycins, unique antimycotics from *Pseudomonas viridisflava*, *J Appl Microbiol*, **84**: 937-944.
- Nagarethinam, S., Anantha N., Ngappa R., Udupa R., Ventaka R.J. and Vananthi M. 2012. Microbial L-Asparaginase and Its Future Prospects. *Asian J. Med. Res.* **1**: 1-4.
- Petrini, O. 1991, *Fungal endophytes of tree leaves*, Springer, New York, 179-197.
- Prescott and Harley, 2000, Laboratory Exercises in Microbiology, 5th edition, The McGraw Hill Co., USA.
- Prihatiningrias, W. dan Wahyuningsih, M.S.H. 2006, ‘Prospek mikroba endofit sebagai sumber senyawa bioaktif’, *Skripsi*, Sarjana Farmasi, Universitas Gadjah Mada, Yogyakarta.
- Purseglove, J.W., Brown, E.G., Green, C.L. and Robbins, S.R.J. 1979, *Spices 1*, Longman, London.

- Satyaranayana, M.N. 2006, Capsaicin and gastric ulcers, *Critical Reviews in Food Science and Nutrition*, **46(4)**: 275-328.
- Schiff, P.B. and Horowitz, S.B. 1980, Taxol stabilizes microtubules in mouse fibroblast cells, *Proc Acad Sci*, **77**:1561-1565.
- Schulz, B. and Boyle, C. 2005, The endophytic continuum, *Mycol Res*, **109(6)**: 661-686.
- Schulz, B., Boyle, C., Draeger, S., Römmert, A.K. and Krohn, K. 2002, Endophytic fungi : a source of novel biologically active secondary metabolites, *Mycol Res*, **106(9)**: 996-1004.
- Selim, K.A., Khan, F. et al. 2012, Biology of Endophytic Fungi, *Current Research in Environmental and Applied Mycology*, **2(1)**: 31-82.
- Shrivastava, A., Khan, A.A., Jain, S.K., Singhal, P.K., Jain, S., Marotta, F. 2010, Biothechnological advancement in isolation of anti-neoplastic compounds from natural origin: a novel source of L-asparaginase, *Acta Biomed*, **81**: 104-108.
- Simmone, A.H., and Archer, D.L. 2012, Acrylamide in foods: a review and update, *Biochem*,**142**-148.
- Singh, Y., Kumar, R., Gundampati, V., Jagannadham, S. and Srivastava, S.K. 2013, Extracellular L-Asparaginase from a Protease-Deficient Bacillus *aryabhattai* ITBHU02: Purification, Biochemical Characterization, and Evaluation of Antineoplastic Activity In Vitro. *Appl Biochem Biotechnol*, **13**: 455.
- Strobel GD. 2003, Bioprospecting for microbial endophytes and their natural product, *Microbiol Mol Biol Rev*. **67(4)**: 491-502.
- Strobel, G. A., Stierle, A., Stierle, D. and Hess, W.M. 1993, Taxomyces *andreanae* a proposed new taxon for a bulbilliferous hyphomycete associated with pacific yew, *Mycotaxon*, **47**:71-78.
- Sudiono, 2006, Effect of fungicide and application against time fruit chili antrknosa disease, *Cytobios*, **4(3)**: 65-155.
- Suffness, M. 1995, Discovery and development of taxol, science and applications, 3-25.
- Taechowisan, T., Lu, C., Shen, Y. and Lumyong, S. 2005, Secondary metabolites from endophytic *Streptomyces aureofaciens* CMUAc130 and their antifungal activity, *Microbiology*, **151**: 1691-1695.

- Tan, R.X. and Zou, W.X. 2001, Endophytes: a rich source of functional metabolites, *Natural Products Rep.* **18**: 448-459.
- Thangavel, A., Krishnamoorthy, G., Subramanian, A. and Maruthamuthu, M. 2013, Seaweed endophytic fungi : A potential source for glutaminase free L-asparaginase, *Che Sci Rev Lett*, **2**: 348-354.
- Theantana, T., Hyde K.D. and Saisamorn L. 2007, Asparaginase production by endophytic fungi from thai medicinal plants: cytotoxicity properties. *Int.J. of Integ. Bio.* **7**: 13-18.
- Van Steenis, C.G.G.J. 2008, *Flora*, Diterjemahkan dari Bahasa Belanda oleh Moeso Surjowinoto, PT Pradnya Paramita, Jakarta.
- Vega, F.E. 2008, Insect pathology and fungal endophytes, *J, Inv, Path*, **98**: 277-279.
- Verma, N., 2007. L-asparaginase: a promising chemotherapeutic Agent. *Crit. Rev. Biotech.* **27**: 45-62.
- Watanabe, T. 2002, *Pictorial Atlas of Soil and Seed Fungi Morphologies of Cultured Fungi and Key to Species*, 2nd ed., CRC Press, USA.
- Wilson, D. 1995, Endophyte-the evolution of term, and clarification of its use and definition, *Oikos*, **73**: 274-276.
- Writson, J.C. and Yellin, T.O. 1973, L-Asparaginase : a review. *Advances in Enzymology*, **39**: 185-248.
- Yano, S., Minato, R., Thongsanit, R., Tachiki, T., and Wakayama M. 2008, Overexpression of type I l-asparaginase of *Bacillus subtilis* in *Escherichia coli*, rapid purification and characterization of recombinant type I l-asparaginase, *Annals of microbiology* **58(4)** : 711-716.
- Youssef, M.M and Al-Omair, M.A. 2008, Cloning, purification, characterization and immobilization of L-asparaginase II from *E.coli* W3310, *Asian Journal of Biochemistry* **3(6)**: 337.
- Zhang, B., Salituro, G., Szalkowski, Z., Li, Y., Zhang, I., and Moller, D.E. 1999, Discovery of small molecule insulin mimetic with antidiabetic activity in mice, *Science*, **248**: 974-981.