

DAFTAR PUSTAKA

- Abu-Elala, N., M. Marzouk, and M. Moustafa. 2013. Use of different *Saccharomyces cerevisiae* biotic forms as immune-modulator and growth promoter for *Oreochromis niloticus* challenged with some fish pathogens. *International Journal of Veterinary Science and Medicine*. 1(1): 21–29.
- Ahmad, I.Z. 2020. Pengaruh Frekuensi Pemberian Probiotik *Bacillus* spp. dan *Lactococcus raffinolactis* terhadap Pertahanan Non Spesifik Seluler Pada Budidaya Lele Dumbo (*Clarias* sp.) dengan Pakan Rendah Protein. Fakultas Pertanian. Universitas Gadjah Mada. Skripsi.
- Aisiah, S. 2012. Efikasi ekstrak mengkudu (*Morinda citrifolia*) terhadap bakteri *Aeromonas hydrophila* dan toksisitasnya pada ikan nila (*Oreochromis niloticus*). *Jurnal Sains Akuatik*. 14(1): 55-63.
- Akhter, N., B. Wu, A.M. Memon, and M. Mohsin. 2015. Probiotics and prebiotics associated with aquaculture: A Review. *Fish and Shellfish Immunology*. 45(2): 733–741.
- Bachtiar, Y. 2006. Panduan Lengkap Budidaya Lele Dumbo. Agro Media, Bogor.
- Bandyopadhyay, P., S. Mishra, B. Sarkar, S.K. Swain, A. Pal, P.P. Tripathy, and S.K. Ojha. 2015. Dietary *Saccharomyces cerevisiae* boosts growth and immunity of IMC *Labeo rohita* (Ham.) juveniles. *Indian Journal of Microbiology*. 55(1): 81–87.
- Beck, B.R., D. Kim, J. Jeon, S.M. Lee, H.K. Kim, O.J. Kim, J.I. Lee, B.S. Suh, H.K. Do, K.H. Lee, W.H. Holzapfel, J.Y. Hwang, M.G. Kwon, and S.K. Song. 2015. The effects of combined dietary probiotics *Lactococcus lactis* BFE920 and *Lactobacillus plantarum* FGL0001 on innate immunity and disease resistance in olive flounder (*Paralichthys olivaceus*). *Fish and Shellfish Immunology*. 42(1): 177–183.
- Chirumbolo, S. 2012. State-of-the-art review about basophil research in immunology and allergy: Is the time right to treat these cells with the respect they deserve? *Blood Transfusion*. 10(2): 148–164.
- Dalmo, R., and J. Børgwald. 2022. Innate Immunity. In: K. Buchmann and C.J. Secombes (Eds.). *Principles of Fish Immunology, From Cells and Molecules to Host Protection*. Springer Nature Switzerland AG, Cham, p: 31–103.
- del Valle, J.C., M.C. Bonadero, and A.V. Fernández-Gimenez. 2023. *Saccharomyces cerevisiae* as probiotic, prebiotic, synbiotic, postbiotics and parabiotics in aquaculture: An overview. *Aquaculture*. 569: 739342.
- Delves, P.J., S.J. Martin, D.R. Burton, and I.M. 2017. Roitt. Roitt's Essential Immunology. 13th ed. Wiley Blackwell, West Sussex.
- Ding, J., T.M. Umstead, J. Floros, and D.S. Phelps. 2004. Factors affecting SP-A-mediated phagocytosis in human monocytic cell lines. *Respiratory Medicine*. 98(7):

637–650.

- Dunier, M.. 1996. Water pollution and immunosuppression of freshwater fish. *Italian Journal of Zoology*. 63(4): 303–309.
- Falaye, A.E., B.O. Emikpe, E.T. Ogundipe, and V.O. Oyebanji. 2017. Effects of dietary supplementation of *Lactobacillus plantarum* on survival, hematological profile and histopathology of selected organs of *Clarias gariepinus* fingerlings. *Comparative Clinical Pathology*. 26(1): 61–69.
- FAO. 2020. The State of World Fisheries and Aquaculture 2018. FAO, Roma.
- FAO. 2022. The State of World Fisheries and Aquaculture 2020. FAO, Roma.
- Fuller, R. 1989. Probiotics in man and animals. *Journal of Applied Bacteriology*. 66(5): 365–378.
- Gasteiger, G., A. D'Ossualdo, D.A. Schubert, A. Weber, E.M. Bruscia, and D. Hartl. 2017. Cellular innate immunity: an old game with new players. *Journal of Innate Immunity*. 9(2): 111–125.
- Gasteiger, G. and A.Y. Rudensky. 2014. Interactions between innate and adaptive lymphocytes. *Nature Reviews Immunology*. 14(9): 631–639.
- Hagi, T., and T. Hoshino. 2009. Screening and characterization of potential probiotic lactic acid bacteria from cultured common carp intestine. *Bioscience, Biotechnology and Biochemistry*. 73(7): 1479–1483.
- Hamid, N.H. H.M. Daud, P. Kayansamruaj, H.A. Hassim, M.S.M. Yusoff, S.N.A Bakar, and P. Srisapoome. 2021. Short- and long-term probiotic effects of *Enterococcus hirae* isolated from fermented vegetable wastes on the growth, immune responses, and disease resistance of hybrid catfish (*Clarias gariepinus* × *Clarias macrocephalus*). *Fish and Shellfish Immunology*. 114: 1–19.
- Hasan, K.N., and G. Banerjee. 2020. Recent studies on probiotics as beneficial mediator in aquaculture: A Review. *The Journal of Basic and Applied Zoology*. 81(1): 1–16.
- Hasan, M.T., W.J. Jang, J.M. Lee, B.J. Lee, S.W. Hur, S.G. Lim, K.W. Kim, H.S. Han, and I.S. Kong. 2019. Effects of immunostimulants, prebiotics, probiotics, synbiotics, and potentially immunoreactive feed additives on olive flounder (*Paralichthys olivaceus*): A review. *Reviews in Fisheries Science and Aquaculture*. 27(4): 417–437.
- Hien, T.T., T.T.T. Hoa, P.T. Liem, S. Onoda, and P.M. Duc. 2021. Effects of dietary supplementation of heat-killed *Lactobacillus plantarum* 1-137 on growth performance and immune response of bighead catfish (*Clarias macrocephalus*). *Aquaculture Reports*. 20: 100741.

- Hodgkinson, J.W., L. Grayfer, and M. Belosevic. 2015. Biology of bony fish macrophages. *Biology*. 4(4): 881–906.
- Isnansetyo, A., A. Fikriyah, N. Kasanah, and Murwantoko. 2016. Non-specific immune potentiating activity of fucoidan from a tropical brown algae (*Phaeophyceae*), *Sargassum cristaefolium* in tilapia (*Oreochromis niloticus*). *Aquaculture International*. 24(2): 465–477.
- Kara, C., A. Alp, and M. Şimşekli. 2010. Distribution of fish fauna on the upper and middle basin of Ceyhan River, Turkey. *Turkish Journal of Fisheries and Aquatic Sciences*. 10(1): 111–122.
- Kavitha, M., M. Raja, and P. Perumal. 2018. Evaluation of probiotic potential of *Bacillus* spp. Isolated from the digestive tract of freshwater fish *Labeo calbasu* (Hamilton, 1822). *Aquaculture Reports*. 11: 59–69.
- Khan, M.I.R., D. Kamilya, T.G. Choudhury, and G. Rathore. 2022. Dietary administration of a host-gut derived probiotic *Bacillus amyloliquefaciens* COFCAU_P1 modulates immune-biochemical response, immune-related gene expression, and resistance of *Labeo rohita* to *Aeromonas hydrophila* infection. *Aquaculture*. 546: 737390.
- Kim, D., B.R. Beck, S.B. Heo, J. Kim, H.D. Kim, S.M. Lee, Y. Kim, S.Y. Oh, K. Lee, H.K. Do, K.H. Lee, W.H. Holzapfel, and S.K. Song. 2013. *Lactococcus lactis* BFE920 activates the innate immune system of olive flounder (*Paralichthys olivaceus*), resulting in protection against *Streptococcus iniae* infection and enhancing feed efficiency and weight gain in large-scale field studies. *Fish and Shellfish Immunology*. 35(5): 1585–1590.
- KKP. 2021. Produksi Perikanan. <https://statistik.kkp.go.id/home.php?m=total&i=2>. Diakses tanggal 3 April 2023.
- Kuebutornye, F.K.A., J. Tang, J. Cai, H. Yu, Z. Wang, E.D. Abarike, Y. Lu, Y. Li, and G. Afriyie. 2020. In vivo assessment of the probiotic potentials of three host-associated *Bacillus* species on growth performance, health status and disease resistance of *Oreochromis niloticus* against *Streptococcus agalactiae*. *Aquaculture*. 527: 735440.
- Lazado, C.C., C.M.A. Caipang, and E.G. Estante. 2015. Prospects of host-associated microorganisms in fish and penaeids as probiotics with immunomodulatory functions. *Fish and Shellfish Immunology*. 45(45): 2–12.
- Leung, T.L.F., and A.E. Bates. 2013. More rapid and severe disease outbreaks for aquaculture at the tropics: Implications for food security. *Journal of Applied Ecology*. 50(1): 215–222.
- Luise, D., P. Bosi, L. Raff, L. Amatucci, S. Viridis, and P. Trevisi. 2022. *Bacillus* spp. probiotic strains as a potential tool for limiting the use of antibiotics, and improving

- the growth and health of pigs and chickens. *Frontiers in Microbiology*. 13: 1–19.
- Lulijwa, R., A.C. Alfaro, F. Merien., M. Burdass, J. Meyer, L. Venter, and T. Young. 2020. Metabolic and immune responses of chinook salmon (*Oncorhynchus tshawytscha*) smolts to a short-term poly (I:C) challenge. *Journal of Fish Biology* 96(3): 731–746.
- Mahyuddin, K. 2008. *Panduan Lengkap Agribisnis Lele*. Penebar Swadaya, Bogor.
- Mangrolia, U., and J.W. Osborne. 2021. Probiotics in counteracting the role of neutrophils in cancer metastasis. *Vaccines*. 9(11): 1–17.
- Mohammadi, G., T.J. Adorian, and G. Rafiee. 2020. Beneficial effects of *Bacillus subtilis* on water quality, growth, immune responses, endotoxemia and protection against lipopolysaccharide-induced damages in *Oreochromis niloticus* under biofloc technology system. *Aquaculture Nutrition*. 26(5): 1476–1492.
- Monzón-Atienza, L., J. Bravo, Á. Fernández-Montero, I. Charlie-Silva, D. Montero, J. Ramos-Vivas, J. Galindo-Villegas, and F. Acosta. 2022. Dietary supplementation of *Bacillus velezensis* improves *Vibrio anguillarum* clearance in European sea bass by activating essential innate immune mechanisms. *Fish and Shellfish Immunology*. 124: 244–253.
- Murphy, K., C. Weaver, and L. Berg. 2022. *Janeway's Immunobiology*. 10th ed. W.W. Norton & Company, New York.
- Mzula, A., P.N. Wambura, R.H. Mdegela, and G.M. Shirima. 2021. Present status of aquaculture and the challenge of bacterial diseases in freshwater farmed fish in Tanzania; A call for sustainable strategies. *Aquaculture and Fisheries*. 6(3): 247–253.
- Nayak, S. K. 2010. Probiotics and immunity: A fish perspective. *Fish and Shellfish Immunology*. 29(1): 2–14.
- Nurhuda, M., M.A. Kholista, Y. Ismi, N. Maulidiya, Hariyadi, and R.R. Hakim. 2018. Effectiveness of cherry leaf extract (*Muntingia calabura*) with different levels as treatment of seeds of sangkuriang catfish (*Clarias gariepinus*) infected by *Trichodina* sp. *Indonesian Journal of Tropical Aquatic*. 1(1): 41–49.
- Pandiyan, P., D. Balaraman, R. Thirunavukkarasu, E.G.J. George, K. Subaramanian, S. Manikkam, and B. Sadayappan. 2013. Probiotics in aquaculture. *Drug Invention Today*. 5(1): 55–59.
- Preanger, C., I.H. Utama, dan I.M. Kardenia. 2016. Gambaran ulas darah ikan lele di Denpasar Bali. *Jurnal Indonesia Medicus Veterinus*. 5(2): 96–103.
- Puspitasari, R.A. 2023. Uji Lapang Pengaruh Pemberian Probiotik *Bacillus* spp., *Lactococcus raffinolactis* dan *Saccharomyces cerevisiae* terhadap Sintasan,

Pertumbuhan, Total Biomassa dan Efisiensi Pakan Lele (*Clarias* sp.). Fakultas Pertanian. Universitas Gadjah Mada. Skripsi.

- Rahardjo, M.F., dan Muniarti. 1984. Anatomi Beberapa Jenis Ikan Ekonomi Penting di Indonesia. Fakultas Perikanan dan Ilmu Kelautan, Institut Pertanian Bogor.
- Reda, R.M., M.A. El-Hady, K.M. Selim, and H.M. El-Sayed. 2018. Comparative study of three predominant gut *Bacillus* strains and a commercial *B. amyloliquefaciens* as probiotics on the performance of *Clarias gariepinus*. *Fish and Shellfish Immunology*. 80: 416–425.
- Ringø, E., S.H. Hoseinifar, K. Ghosh, H. van Doan, B.R. Beck, and S.K. Song. 2018. Lactic acid bacteria in finfish-an update. *Frontiers in Microbiology*. 9: 1–37.
- Ringø, E., H. van Doan, S.H. Lee, M. Soltan, S.H. Hoseinifar, R. Harikrishnan, and S.K. Song. 2020. Probiotics, lactic acid bacteria and bacilli: Interesting supplementation for aquaculture. *Journal of Applied Microbiology*. 129(1): 116–136.
- Rohani, M.F., S.M. Islam, M.K. Hossain, Z. Ferdous, M.A.B. Siddik, M. Nuruzzamann, U. Padeniya, C. Brown, and M. Shahjahan. 2022. Probiotics, prebiotics and synbiotics improved the functionality of aquafeed: Upgrading growth, reproduction, immunity and disease resistance in fish. *Fish and Shellfish Immunology*. 120: 569–589.
- Rombout J.H.W.M., L. Abelli, S. Picchietti, G. Scapigliati, and V. Kiron. 2011. Teleost intestinal immunology. *Fish and Shellfish Immunology*. 31(5): 616–626.
- Rustikawati, R.J. 2012. Efektivitas ekstrak *Sargassum* sp. terhadap diferensial leukosit ikan nila *Oreochromis niloticus* yang diinfeksi *Streptococcus iniae*. *Jurnal Akuatika*. 3(2): 125–134.
- Saanin, H. 1984. Taksonomi dan Kuntji Identifikasi Ikan. Binatjipta, Bogor.
- Salasia, S.I.O., D. Sulanjari, dan A. Ratnawati. 2001. Studi hematologi ikan air tawar. *Biologi*. 2(12): 710–723.
- Santos, R.A., N. Mariz-Ponte, N. Martins, R. Magalhães, R. Jerusik, M.J. Saavedra, H. Peres, A. Oliva-Teles, and C.R. Serra. 2022. In Vitro modulation of gilthead seabream (*Sparus aurata* L.) leukocytes by *Bacillus* spp. extracellular molecules upon bacterial challenge. *Fish and Shellfish Immunology*. 121: 285–294.
- Santos, G.G., M.C.M. Libanori, S.A. Perreira, J.V.S. Ferrarezi, M.B. Ferreira, T.A. Soligo, E. Yamashita, M.L. Martins, and J.L.P. Mourino. 2023. Probiotic mix of *Bacillus* spp. and benzoic organic acid as growth promoter against *Streptococcus agalactiae* in Nile tilapia. *Aquaculture*. 566: 739212.
- Santulli-Marotto, S., A. Gervais, J. Fisher, B. Strake, C.A. Ogden, C. Riveley, and J. Giles-Komar. 2015. Discovering molecules that regulate efferocytosis using primary

- human macrophages and high content imaging. *PLoS One*. 10(12): e0145078.
- Schalm, J.W., and N.C. Jain. 1986. *Schalm's Veterinary Hematology*. Lea & Febiger, New York.
- Semple, S.L., and B. Dixon. 2020. Salmonid antibacterial immunity: An aquaculture perspective. *Biology*. 9(10): 1–35.
- Smith, N.C., M.L. Rise, and S.L. Christian. 2019. A comparison of the innate and adaptive immune systems in cartilaginous fish, ray-finned fish, and lobe-finned fish. *Frontiers in Immunology* 10: 1–23.
- Sompayrac, L. 2016. *How the Immune System Works (The How It Works Series)*. 5th ed. John Wiley & Sons, West Sussex.
- Sundberg, L.R., T. Ketola, E. Laanto, H. Kinnula, J.K.H. Bamford, R. Penttinen, and J. Mappes. 2016. Intensive aquaculture selects for increased virulence and interference competition in bacteria. *Proceedings of the Royal Society B: Biological Sciences* 283: 1826.
- Tachibana, L, G.S. Telli, D. de Carla Dias, G.S. Goncalves, M.C. Guimaraes, C.M. Ishikawa, R.B. Cavalcante, M.M. Natori, M.F.F. Alarcon, S. Tapia-Paniagua, M.A. Morinigo, F.J. Moyano, and M.J.T. Ranzani-Paiva. 2020. *Bacillus subtilis* and *Bacillus licheniformis* in diets for Nile tilapia (*Oreochromis niloticus*): Effects on growth performance, gut microbiota modulation and innate immunology. *Aquaculture Research*. 52(4): 1630–1642.
- Taherpour, M., L. Roomiani, H.R. Islami, and M.S. Mehrgan. 2023. Effect of dietary butyric acid, *Bacillus licheniformis* (probiotic), and their combination on hemato-biochemical indices, antioxidant enzymes, immunological parameters, and growth performance of rainbow trout (*Oncorhynchus mykiss*). *Aquaculture Reports*. 30: 101534.
- Tavares-Dias, M., and F.R. De Moraes. 2007. Leukocyte and thrombocyte reference values for channel catfish (*Ictalurus punctatus* Raf), with an assessment of morphologic, cytochemical, and ultrastructural features. *Veterinary Clinical Pathology* 36(1): 49–54.
- Thy, H.T.T., N.N. Tri, O.M. Quy, R. Fotedar, K. Kannika, S. Unajak, and N. Areechon. 2017. Effects of the dietary supplementation of mixed probiotic spores of *Bacillus amyloliquefaciens* 54A, and *Bacillus pumilus* 47B on growth, innate immunity and stress responses of striped catfish (*Pangasianodon hypophthalmus*). *Fish and Shellfish Immunology* 60: 391–399.
- Uribe, C., H. Folch, R. Enriquez, and G. Moran. 2011. Innate and adaptive immunity in teleost fish: A Review. *Veterinarni Medicina*. 56(10): 486–503.
- Vallés, P.G., A.G. Lorenzo, V. Bocanegra, and R. Vallés. 2014. Acute kidney injury:

What part do toll-like receptors play? *International Journal of Nephrology and Renovascular Disease*. 7: 241–251.

- Yanuhar, U., D. K.W.P. Raharjo, N. R. Caesar, and N. S. Junirahma. 2021. Hematology response of catfish (*Clarias* sp.) as an indicator of fish health in Tuban Regency. *IOP Conference Series: Earth and Environmental Science* 718(1): 1–6.
- Yeganeh, S., M. Adel, A. Nosratimovafagh, and M.A.O. Dawood. 2021. The effect of *Lactococcus lactis* subsp. *lactis* PTCC 1403 on the growth performance, digestive enzymes activity, antioxidative status, immune response, and disease resistance of rainbow trout (*Oncorhynchus mykiss*). *Probiotics and Antimicrobial Proteins* 13(6): 1723–1733.
- Yousefi, B., M. Eslami, A. Ghasemian, P. Kokhaei, A.S. Farrokhi, and N. Darabi. 2019. Probiotics importance and their immunomodulatory properties. *Journal of Cellular Physiology*. 234(6): 8008–8018.
- Zorriehzahra, M.J., S.T. Delshad, M. Adel, R. Tiwari, K. Karthik, K. Dhama, and C.C. Lazado. 2016. Probiotics as beneficial microbes in aquaculture: an update on their multiple modes of action: A review. *Veterinary Quarterly*. 36(4): 228–241.