



DAFTAR PUSTAKA

- Abdel-Aziz, M.F.A., H.U. Hassan, A. Yones, Y.A. Abdel-Tawwab, and A.A.A. Metwalli. 2021. Assessing the effect of different feeding frequencies combined with stocking density, initial weight, and dietary protein ratio on the growth performance of tilapia, catfish and carp. *Scientific African*. 12: 1-15.
- Abdel-Latif, H.M.R., M.R. Chaklader, M. Shukry, H.A. Ahmed, and M.A. Khallaf. 2023. A multispecies probiotic modulates growth, digestive enzymes, immunity, hepatic antioxidant activity, and disease resistance of *Pangasianodon hypophthalmus* fingerlings. *Aquaculture* 563: 1-11.
- Abdel-Tawwab, M. 2012. Interactive effects of dietary protein and live bakery yeast, *Saccharomyces cerevisiae* on growth performance of Nile Tilapia, *Oreochromis niloticus* (L.) fry and their challenge against *Aeromonas hydrophila* infection. *Aquacult. Int.* 20: 317-331.
- Aguirre-Guzman, G., M. Lara-Flores, J.G. Sanchez-Martinez, A.I. Campa-Cordova, A. Luna-Gonzalez. 2012. The use of probiotics in aquatic organisms: a review. *Afr J Microbiol Res.* 6(23): 4845-4857.
- Ahmad, I.A. 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.
- Ahmad, R.Z. 2005. Pemanfaatan khamir *Saccharomyces cerevisiae* untuk ternak. *Wartazoa*. 15(1): 49-55.
- Allameh, S.K., V. Noaman, and R. Nahavandi. 2017. Effects of probiotic bacteria on fish performance. *Insight Medical Publishing Journals*. 1(2): 11-15.
- Anderson, D.P. and A.K. Siwicki. 1993. Basic hematology and serology for fish health programs. Paper Presented in Second Symposium on Diseases in Asia Aquaculture "Aquatic Animal Health and The Environmental". Phuket Thailand.
- Anderson, D.P. and A.K. Siwicki. 1994. Simplified assay for measuring non-specific defence mechanism in fish. Fish Health Section/American Fisheries Meeting, Seattle Washington.
- Anzalina, M.C. 2023. Pengaruh Probiotik *Bacillus spp.*, *Lactococcus raffinolactis* dan *Saccharomyces cerevisiae* Terhadap Kualitas Air pada Budidaya Lele (*Clarias sp.*). Fakultas Pertanian. Skripsi.
- Ayuningtyas, S.Q., M.Z. Jr., and Widanarni. 2020. Reproductive performance of catfish *Clarias sp.* with probiotics *Bacillus sp.* NP5 addition through feed. *Jurnal Akuakultur Indonesia*. 19(1): 74-83.
- Azhari, M., L. Handayani, and Nurhayati. 2020. Pengaruh penambahan arang aktif terhadap tulang ikan pada pakan terhadap gambaran darah ikan nila (*Oreochromis niloticus*). *Jurnal TILAPIA* 1(2): 19-27.



Balcazar, J.L., I. de Blas, I. Ruiz-Zarzuela, D. Cunningham, D. Vendrell, and J.L. Muzquiz. 2006. The role of probiotics in aquaculture. *Vet Microbiol.* 114: 173-186.

Bayne, C.J., L. Gerwick, K. Fujiki, M. Nakao, and T. Yano. 2001. Immune-relevant (including acute, phase) genes identified in the livers of rainbow trout, *Oncorhynchus mykiss*, by means of suppression subtractive hybridization. *Development and Comparative Immunology.* 25(3): 205-217.

Biller-Takahashi, J.D., L.S. Takahashi, F. Pilarski, F.A., and E.C. Urbinati. 2013. Serum bactericidal activity as indicator of innate immunity in pacu *Piaracatus mesopotamicus* (Holmberg, 1887). *Arq. Bras Med. Vet. Zootec.* 65(6): 1745-1751.

Boonanuntasarn, S., K. Ditthab, A. Jangprai, and C. Nakhruhai. 2019. Effects of microencapsulated *Saccharomyces cerevisiae* on growth, hematological indices, blood chemical, and immune parameters and intestinal morphology in striped catfish, *Pangasianodon hypophthalmus*. *Probiotics and Antimicrobial Protein.* 11: 427-437.

Bowser, P.R. 1999. Diseases of Fish. Cornell University, New York.

Bradford, M.M. 1976. A rapid and sensitive method for quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Analitical Biochemistry.* 72: 248-254.

Bratawidjaja, K.G. dan I. Rengganis. 2004. Imunologi Dasar, Edisi Keenam. Badan Penerbit Fakultas Kedokteran Universitas Indonesia, Jakarta.

Bromage, E.S., I.M. Kaattari, P. Zwollo, and S.L. Kaattari. 2004. Plasmablast and plasma cell production and distribution in trout immune tisseus. *Journal Immunol* 173: 7317-7327.

Brown, M. 2011. Modes of action of probiotics: resent developments. *J Anim Vet Adv.* 10(4): 1895-1900.

Cabillon, N.A.R. and C.C. Lazado. 2019. Mucosal barrier functions of fish under changing environmental conditions. *Fishes.* 4(2): 1-10.

Charlie-Silva, I., A. Klein, J.M.M. Gomes, E.J.R. Prado, A.C. Moraes, S.F. Eto, D.C. Fernandes, J.J. Fagliari, J.D.C. Junior, C. Lima, M. Lopes-Ferreira, K. Conceicao, W.G. Manrique, and M.A.A. Belo. 2019. Acute-phase proteins during inflammatory reaction by bacterial infection: Fish-model. *Scientific Reports.* 9(1): 1-13.

Chernyavkikh, S.D., Z.A. Borodaevara, I.P. Borisovkiy, S.I. Ostapenk, and O.A. Galtseva. 2019. Blood protein spectrum in representatives of the fish superklass. *EurAsian Journal of BioSciences.* 13: 979-981.

Darafish, F., M. Soltani, H.A. Abdolhay, Shamsei, and M. Mehrejan. 2020. Improvement of growth performance, digestive enzymes and body composition of persian sturgeon (*Acipenser persius*) following feeding on probiotics: *Bacillus*



licheniformis, *Bacillus subtilis*, and *Saccharomyces cerevisiae*. Aquac. Res. 51(3): 957-964.

Dawood, M.A., S. Koshio, M. Ishikawa, and S. Yokoyama. 2015. Effects of partial substitution of fish meal by soybean meal with or without heat-killed *Lactobacillus plantarum* (LP20) on growth performance, digestibility, and immune response of amberjack, *Seriola dumerili* juveniles. BioMed Research International. 1-11.

Dhanarso, P., H. Yunissa, I. Istiqomah, and A. Isnansetyo. 2021. Complement system activation in red tilapia (*Oreochromis sp.*) orally administrated with probiotics SEAL. IOP Conf. Ser.: Earth Environ. Sci. 718: 1-6.

Diniarti, E., Triyanto, dan Murwantoko. 2019. Isolasi, identifikasi, dan uji patogenisitas *Edwardsiella tarda* penyebab penyakit pada ikan air tawar di Yogyakarta. Jurnal Perikanan. 21(1): 41-45.

Divya, M., N. Gopi, A. Iswarya, M. Govindarajan, N.S. Alharbi, S. Kadaikunnan, J.M. Khales, T.N. Almanaa, and B. Vaseeharan. 2020. B-glucan extracted from eukaryotic single-called microorganism *Saccharomyces cerevisiae*: Dietary supplementation and enhanced ammonia stress on *Oreochromis mossambicus*. Microbial Pathogenesis. 139: 1-8.

Divyagnaneswari, M., D. Christyapita, and R.D. Michael. 2007. Enhancement of nonspecific immunity and disease resistance in *Oreochromis mossambicus* by *Solanum tribatum* leaf fractions. Fish Shellfish Immunol. 23: 249-259.

Dong, H.T., C. Techatanakitarnan, P. Jindakittkul, A. Thaiprayoon, S. Taengphu, W. Charoensapsri, P. Khunrae, T. Rattanarojpong, and S. Senapin. 2017. *Aeromonas jandei* and *Aeromonas veronii* caused disease and mortality in nile tilapia, *Oreochromis niloticus* (L.). Journal of Fish Diseases. 40(10): 1395-1403.

Ekawati, A.W., S.M. Ulfa, C.S.U. Dewi, A.A. Amin, L.N. Samalamh, A.T. Yanuar, and A. Kurniawan. 2021. Analysis of aquaponic-recirculation aquaculture system (A-RAS) application in the catfish (*Clarias gariepinus*) aquaculture in Indonesia. Aquaculture Studies. 21(3): 93-100.

Enzeline, V., H. Nasrullah, A.O. Sudrajat, M.Z. Jr., A. Alimudin, and W. Widanarni. 2022. Spermatogenesis and sperm quality of male African catfish fed with *Bacillus* sp. NP5 probiotic supplemented diet. AACL Bioflux. 15(1): 339-349.

Feliarta, I. Efendi, dan E. Suryadi. 2004. Isolasi dan identifikasi bakteri probiotik dari ikan kerapu macan (*Ephinephelus fuscoguttatus*) dalam upaya efisiensi pakan ikan. Jurnal Natur Indonesia. 6(2): 75-80.

Gaffar, A.A., A. Rasyid, dan Y. Suryaningsih. 2020. Budidaya ikan lele sangkuriang dengan sistem bioflok di Desa Jerukleueut Kecamatan Sindangwangi Kabupaten Majalengka. BERNAS: Jurnal Pengabdian Kepada Masyarakat. 1(3): 159-163.

Garcia-Weber, D., A. Dangeard, J. Cornil, L. Thai, H. Rytter, A. Zamyatina, L.A. Mulard, and C. Arrierumerlou. 2018. ADP-hetose is a newly identified pathogen-associated molecular pattern of *Shigella flexneri*. EMBO Rep 19(12): 1-13.



Gioacchini, G., E. Giorgini, L. Vaccari, and O. Carnevali. 2014. Can Probiotics Affect Reproductive Processes of Aquatic Animals? In Aquaculture Nutrition: Gut Health, Probiotics and Prebiotics. John Wiley & Sons, New Jersey.

Giri, S.S., V. Sukumaran, and M. Oviya. 2013. Potential probiotic *Lactobacillus plantarum* VSG3 improves the growth, immunity, and disease resistance of tropical freshwater fish, *Labeo rohita*. Fish and Shellfish Immunology. 3(4): 660-666.

Gobi, N., B. Vaseeharan, J. Chen, R. Rekha, S. Vijayakumar, M. Anjungan, and A. Iswarya. 2018. Dietary supplementation of probiotic *Bacillus licheniformis* Dahb1 improves growth performance, mucus and serum immune parameters, antioxidant enzyme activity as well as resistance against *Aeromonas hydrophila* in tilapia *Oreochromis mossambicus*. Fish and Shellfish Immunology. 74: 501-508.

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.

Hasna, J.F.H. 2023. Uji Lapang Pengaruh Pemberian Probiotik *Bacillus spp.*, *Lactococcus raffinolactis*, dan *Saccharomyces cerevisiae* pada Pakan Terhadap Respon Imun Non-Spesifik Seluler Lele (*Clarias sp.*). Fakultas Pertanian. Universitas Gadjah Mada. Skripsi.

Hastuti, S.D. 2012. Suplementasi β -glukan dari ragi roti (*Saccharomyces cerevisiae*) dalam pakan terhadap aktivitas fagositosis, aktivitas NBT, total protein plasma, dan aktivitas aglutinasi pada darah ikan nila (*Oreochromis niloticus*). DEPIK Jurnal Ilmu-Ilmu Perairan, Pesisir, dan Perikanan. 1(3): 149-155.

Isnantomo, D. 2020. Pengaruh Frekuensi Pemberian Probiotik *Bacillus spp.* dan *Lactococcus raffinolactis* pada Pakan Berprotein Rendah terhadap Respon Umum Non-Spesifik Humoral Lele (*Clarias sp.*). Fakultas Pertanian. Universitas Gadjah Mada. Skripsi.

Izzah, N., S. Arsal, dan A.W. Ekawati. 2019. Pengaruh penambahan probiotik dan minyak ikan pada pakan terhadap histopatologi lambung ikan sidat (*Anguilla sp.*). Journal of Fisheries and Marine Research. 3(1): 81-85.

Jahangiri, L. and M.A. Esteban. 2018. Administration of probiotics in the water in finfish aquaculture systems: a review. Fishes. 3(33): 33-45.

Jarmolowicz, S., Z. Zaker, A. Siwicki, A. Kowalska, M. Hopko, E. Glabski, Z. Demska, and K. Partyka. 2011. Effects of brewer's yeast extract on growth performance and health of juvenile pikeperch *Sanderluciooperca* (L.). Aquaculture Nutrition. 18(4): 457-464.

Jayanti, N. 2019. Pengaruh Pemberian Probiotik Secara Oral Terhadap Pertahanan Tubuh Non-Spesifik Humoral Ikan Lele (*Clarias sp.*). Fakultas Pertanian. Universitas Gadjah Mada. Skripsi.



Jung, H.W., G.K. Panigrahi, G.Y. Jung, Y.J. Lee, K.H. Shin, A. Sahoo. E.S. Choi, E. Lee, K.M. Kim, S.H. Yang, J. Jeon, S.C. Lee, and S.H. Kim. 2020. Pathogen-associated molecular pattern-triggered immunity involves proteolytic degradation of core nonsense-mediated mRNA decay factors during the early defense response. *Plant Cell* 32(4): 1081-1101.

Kamaruddin, Lideman, Usman, dan B.R. Tampangallo. 2019. Suplementasi ragi roti (*Saccharomyces cerevisiae*) dalam pakan pembesaran ikan baronang (*Siganus guttatus*). *Media Akuakultur*. 14(2): 97-104.

Kapoor, R. 1989. Fresh Water Fishes of The World. Cosmo Publications, New Delhi.

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, A. and K. Ghosh. 2013. Evaluation of phytase production by fish gut bacterium, *Bacillus subtilis*, for processing of *ipomea aquatica* leaves as probable aquafeed ingredient. *J. Aquat. Food Prod. Technol.* 22: 508–519.

Khotimah, K., E.D. Harmilia, dan R. Sari. 2016. Pemberian probiotik pada media pemeliharaan benih ikan patin (*Pangasius hypophthalmus*) dalam akuarium. *Jurnal Akuakultur Rawa Indonesia*. 4(2): 152-158.

Kimoto-nera, H., R. Aoki, K. Mizumachi, K. Sasaki, H. Naito, T. Sawada, and C. Suzuki. 2012. Interaction between *Lactococcus lactis* and *Lactococcus raffinolactis* during growth in milk: Development of a new starter culture. *Diary Science*. 95(4): 2176-2185.

KKP. 2021. Produksi Perikanan. <https://statistik.kkp.go.id/home.php?m=total&i=2>. Diakses tanggal 29 Oktober 2023.

Kristianingrum, Y.P., B. Sutrisno, S. Widyarini, Kurniasih, and Sugiono. 2021. Disease incidence of freshwater fish in the Special Region of Yogyakarta, Indonesia. *BIO Web of Conferences*. 33: 1-8.

Kuebutornye, F.K.A., E.D. Abarike, Y. Lu, V. Hlordzi, M.E. Sakyi, G. Afriyie, Z. Wang, Y. Li, and C.X. Xie. 2020. Mechanisms and the role of probiotic *Bacillus* in mitigating fish pathogens in aquaculture. *Fish Physiol. Biochem.* 46: 819-841.

Kumar, R., S.C. Mukherjee, R. Ranjan, and S.K. Nayak. 2008. Enhanced innate immune parameters in *Labeo rohita* (Ham.) following oral administration of *Bacillus subtilis*. *Fish & Shellfish Immunology* 24: 168-172.

Kumar, R., S.C. Mukherjee, K.P. Prasad, and A.K. Pal. 2006. Evaluation of *Bacillus subtilis* as a probiotic to Indian major carp *Labeo rohita* (Ham.). *Aquac. Res.* 37(12): 1215-1221.

Kuswanto, C.W., B. Rohman, and G.Y. Denata. 2022. Budikdamber training: efforts to optimize the utilization of home yard. *Smart Society: Community Service and Empowerment Journal*. 2(1): 9-17.



- Lam, S., H. Chua, Z. Gong, T. Lam, and Y. Sin. 2004. Development and maturation of the immune system in zebrafish, *Danio rerio*: a gene expression profiling, in situ hybridization and immunological study. *Developmental and Comparative Immunology*. 28: 9-28.
- Lanier, L. 2005. NK cell recognition. *Annu Rev Immunol* 23: 225-274.
- Lee, S., K. Katya, Y. Park, S. Won, M. Seong, and S.C. Bai. 2017. Comparative evaluation of dietary probiotics *Bacillus subtilis* WB60 and *Lactobacillus plantarum* KCT3928 on the growth performance, immunological parameter, gut morphology and disease resistance in Japanese eel, *Anguilla japonica*. *Fish & Shellfish Immunology*. 61: 201-210.
- Lestari, R., H. Syawal, and I. Lukityowati. 2023. Hematology of asian redtail catfish (*Hemibagrus nemurus*) reared in media with regular addition of probiotics. *Asian Journal of Aquatic Sciences*. 6(1): 10-20.
- Li, J., Z. Wu, Z. Zhang, J. Zha, S. Qu, X. Qi, and G. Wang. 2019. Effects of potential probiotic *Bacillus velezensis* K2 on growth, immunity and resistance to *Vibrio harveyi* infection of hybrid grouper (*Epinephelus lanceolatus* X *E. fuscoguttatus*). *Fish and Shellfish Immunology*. 93: 1047-1055.
- Liu, C., K. Wu, T. Chu, and T. Wu. 2018. Dietary supplementation of probiotic, *Bacillus subtilis* E20, enhances the growth performance and disease resistance against *Vibrio alginolyticus* in parrot fish (*Oplegnathus fasciatus*). *Aquacult. Int.* 26: 63-74.
- Liu, H., S. Wang, Y. Cai, X. Guo, Z. Cao, Y. Zhang, S. Liu, W. Yuan, W. Zhu, and Y. Zheng. 2017. Dietary administration of *Bacillus subtilis* HAINUP40 enhances growth, digestive enzyme activities, innate immune responses and disease resistance of tilapia, *Oreochromis niloticus*. *Fish & Shellfish Immunology* 60: 326-333.
- Lobo, V., A. Patil, A. Phatak, and N. Chandra. 2010. Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacognosy Reviews*. 4(8): 118-126.
- Manoppo, H. dan M.E.F. Kolopita. 2015. Pengembuhan ragi roti dalam pakan meningkatkan respons imun nonspesifik dan pertumbuhan ikan nila. *Jurnal Vateriner*. 16(2): 204-211.
- Masjudi, H., U.M. Tang, dan H. Syawal. 2016. Kajian tingkat stress ikan tapah (*Wallago leeri*) yang dipelihara dengan pemberian pakan dan suhu yang berbeda. *Berkala Perikanan Terubuk* 44(3): 69-83.
- Meidong, R., S. Doolgindachbaporn, K. Sakai, and S. Tongpim. 2017. Isolation and selection from *Seriola lalandi* cultures for aquaculture application. *Aquaculture Research*. 48: 4308-4320.
- Monghaddam, M.M., H. Aghamollaei, H. Kooshki, K.A. Barjini, R. Mirnejad, and A. Choopani. 2015. The development of antimicrobial peptides as an approach to prevention of antibiotic resistance. *Rev. Med. Microbiol.* 26(3): 98-110.



Monzon-Atienza, L., J. Bravo, A. Fernandez-Montero, I. Charlie-Silva, D. Motero, J. Ramos-Vivas, J. Galindo-Villegas, and F. Acosta. 2022. Dietary supplementation of *Bacillus velenzis* improves *Vibrio anguillarum* clearance in European sea bass by activating essential innate immune mechanisms. Fish and Shellfish Immunology. 124: 244-253.

Muchlisin, Z.A., M. Nazir, N. Fadli, M. Adlim, A. Hendri, M. Khalil, and M.N. Siti-Azizah. 2017. Efficacy of commercial diets with varying levels of protein on growth performance, protein and lipid contents in carcass of Acehnese mahseer, tor Tambra. Iranian Journal of Fisheries Sciences. 16(2): 557-566.

Mulyani, Y., I. Maulina, P.P. Bagaskhara, A. Rahmadianto, A. Riyanto, dan R. Nurfadillah. 2021. Edukasi manajemen pemberian pakan dalam budidaya ikan lele di pekarangan sempit bagi masyarakat Desa Raharja, Kecamatan Tanjungsari, Kabupaten Sumedang. Farmers: Journal of Community Services. 2(2): 2-14.

Munang'andu, H.M., B.N. Fredriksen, S. Mutoloki, R.A. Dalmo, Ø. Evensen. 2013. Antigen dose and humoral immune response correspond with protection for inactivated infectious pancreatic necrosis virus vaccines in Atlantic salmon (*Salmo salar* L). Vet. Res. 44(1): 1-16.

Munirasu, S., V. Ramasubramanian, and P. Arunkumar. 2017. Effect of probiotics diet on growth and biochemical performance of freshwater fish *Labeo rohita* fingerlings. JEZS. 5(3): 1374-1379.

Mutologi, S., J.B. Jørgensen, and Ø. Evensen. 2014. The Adaptive Immune Response in Fish. Fish vaccination. John Wiley & Sons, Ltd., New Jersey.

Myburgh, J.G., C.J. Botha, D.G. Booysse, and F. Reyers. 2008. Provisional clinical chemistry parameters in the African sharptooth catfish (*Clarias gariepinus*). Journal South African Veterinerier Association. 79(4): 156-160.

Nandy, S.K. and R.K. Srivastava. 2018. A review on sustainable yeast biotechnological processes and applications. Microbiol. Res. 207: 83-90.

Nargesi, E.A., B. Falahatkar, and M.M. Sajjadi. 2020. Dietary supplementation of probiotics and influence on feed efficiency, growth parameters and reproductive performance in female rainbow trout (*Oncorhynchus mykiss*) broodstock. Aquaculture Nutrition. 26: 98-108.

Nauta, A.J., M.R. Daha, V.C. Kooten, and A. Roos. 2003. Recognition and clearance of apoptotic cells: a role for complement and pentraxins. Trends Immunol. 24(3): 148-154.

Nugroho, R.A. dan F.M. Nur. 2018. Potensi Bahan Hayati Sebagai Imunostimulan Hewan Akuatik. Penerbit Deepublish, Yogyakarta.

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.



- Ogueji, E., C. Nawani, C. Mbah, S. Iheanacho, and F. Nweke. 2020. Oxidative stress, biochemical, lipid peroxidation, and antioxidant responses in *Clarias gariepinus* exposed to acute concentrations of ivermectin. Environ. Sci. Pollut Control Ser. 27: 16806-16815.
- Oishi, Y. and I. Manabe. 2018. Macrophages in inflammation, repair and regeneration. International Immunol 30: 511-528.
- Olivia, A. and Teles. 2012. Nutrition and health of aquaculture fish. Journal of Fish Diseases 35: 83-103.
- Olmos, J. and J. Paniagua-Michel. 2014. *Bacillus subtilis* a potential probiotic bacterium to formulate functional feeds for aquaculture. Journal of Microbial & Biochemical Technology. 6(7): 361-365.
- Opiyo, M.A., J. Jumber, C.C. Ngugi, and H. Charo-Karisa. 2019. Different levels of probiotics affect growth, survival and body composition of nile tilapia (*Oreochromis niloticus*) cultured in low input ponds. Sci. Afr. 4: 1-7.
- Payung, C.N. dan H. Manoppo. 2015. Peningkatan respon kebal non-spesifik dan pertumbuhan Ikan Nila (*Oreochromis niloticus*) melalui pemberian Jahe, *Zingiber officinale*. Jurnal Budidaya Perairan 3(11): 11-18.
- 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.
- Rachmawati, D., I. Samidjan, dan D. Nurhayati. 2021. Pengaruh penambahan *Saccharomyces cerevisiae* pada pakan komersial terhadap performan benih ikan baung (*Hemibagrus nemurus*). Pena Akuatika: Jurnal Ilmiah Perikanan dan Kelautan. 20(2): 35-35.
- Ragland, S.A. and A.K. Criss. 2017. From bacterial killing to immune modulation: recent insights into the function of lysozyme, PLoS Pathog. 13(9): 1-22.
- Rajaram, M.V., B. Ni, C.E. Dodd, and L.S. Schlesinger. 2014. Macrophage immunoregulatory pathways in tuberculosis. Semin. Immunol 26: 471-485.
- Ramesh, D., S. Souissi, and T.S. Ahamed. 2017. Effects of the potential probiotics *Bacillus aerophilus* KADR3 inducing immunity and disease resistance in *Labeo rohita*. Fish Shellfish Immunol. 70: 408-415.
- Rashidian, G., M.M. Moghaddam, R. Mienejad, dan Z.M. Azad. 2021. Supplementation of zebrafish (*Danio rerio*) diet using a short antimicrobial peptide: evaluation of growth performance, immunodulatory function, antioxidant activity, and disease resistance. Fish and Shellfish Immunology. 119: 42-50.
- Rawung, M.E. dan H. Manoppo. 2014. Penggunaan ragi roti (*Saccharomyces cerevisiae*) secara in situ untuk meningkatkan respon kebal non-spesifik ikan nila (*Oreochromis niloticus*). Budidaya Perairan. 2(2): 7-14.



Riera, R.M., D. Perez-Martinez, and F.C. Castillo. 2016. Innate immunity in vertebrates: an overview. *Immunologi*. 148: 125-139.

Roberson, B.S. 1990. Bacterial agglutination. *Techniques in Fish Immunology*. 1: 81-86.

Roberts, R.J. 2012. The Immunology of Teleosts. *Fish Pathology*. John Wiley & Sons, Ltd., New Jersey.

Rodriguez-Estrada, U., S. Satoh, Y. Haga, H. Fushimi, and J. Sweetman. 2013. Effects on inactivated *Enterococcus faecalis* and mannan oligosaccharide and their combination on growth, immunity, disease protection in rainbow trout. *North American Journal of Aquaculture*. 75(3): 416-428.

Rohani, M.F., S.M. Islam, M.K. Hossain, Z. Ferdous, M.A. Sidiik, M. Nuruzzaman, U. Padenny, 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 Shellfish Immunol*. 120: 569-589.

Rohani, M.F., S.M.M. Islam, M.K. Hossain, Z. Ferdous, M.A.B. Siddik, M. Nuruzzaman, U. Padenny, 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.

Romo, M.R., D. Perez-Martinez, and C.C. Ferrer. 2016. Innate immunity in vertebrates: an overview. *Immunology* 148(2): 125-139.

Roy, S., V. Kumar, V. Kumar, and B.K. Behera. 2017. Acute phase proteins and their potential role as an indicator for fish health and in diagnosis of fish diseases. *Protein and Peptide Letters*. 24(1): 78-89.

Rustadi. 2018. Manajemen Akuakultur Tawar. Gadjah Mada University Press, Yogyakarta.

Saanin, S. 1968. Taksonomi dan Kuntji Identifikasi Ikan. Binacipta, Bandung.

Saputra, F., Y. Ibrahim, D. Islama, Mahendra, M.A. Nasution, dan I. Khairi. 2022. Pemberian probiotik untuk optimalisasi kelangsungan hidup dan pertumbuhan ikan gabus local (*Channa sp.*) hasil domestikasi. *Jurnal Perikanan Tropis*. 9(1): 37-46.

Saurabh, S. and P.K. Sahoo. 2008. Lysozyme: an important defence molecule of fish innate immune system. *Aquaculture Research*. 39: 223-239.

Saurabh, S. and P.K. Sahoo. 2008. Lysozyme: An important defence molecule of fish innate immune system. *Aquac. Res.* 39: 223-239.

Secombes, C.J. 1990. Isolation of salmonid macrophages and analysis of their killing activity. *Techniques in Fish Immunology*. 1: 137-163.

Setyaningrum, N., Sugiharto, dan S. Sukmaningrum. 2020. Peningkatan produksi ikan lele dumbo dengan pemberian suplemen vitamin c. *Dinamika Journal*. 2(1): 1-7.



- Shilman, M.I., W. Sukendar, R.A. Hutagalung, dan A. Kurniawan. 2020. Gambaran eritrosit, leukosit dan performa pertumbuhan ikan baung (*Hemibagrus nemurus*) yang diberi pakan dengan penambahan ragi roti komersil (*Saccharomyces cerevisiae*). Journal of Aquaculture Science. 5(2): 110-119.
- Shoemaker, C.A., P.H. Klesius, and J.J. Evans. 2001. Pravelanve of *Streptococcus iniae* in tilapia, hybrid striped bass, and channel catfish on commercial fish farms in the United States. American Journal of Veterinary Research. 62: 174-177.
- Simanjuntak, N., I.Putra, dan N.A. Pamungkas. 2020. Pengaruh pemberian probiotik em4 pada pakan terhadap pertumbuhan dan kelulushidupan benih ikan lele sangkuriang (*Clarias sp.*) dengan teknologi bioflok. Jurnal Akuakultur SEBATIN. 1(1): 63-69.
- Sitohang, R.V., T. Herawati, dan W. Lili. 2012. Pengaruh pemberian dedak padi hasil fermentasi ragi (*Saccharomyces cerevisiae*) terhadap pertumbuhan biomassa *Daphnia* sp. Jurnal Perikanan dan Kelautan. 3(1): 65-72.
- 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.
- Soedibya, P.H.T., T.B. Pramono, dan E. Listiowati. 2017. Kinerja pertumbuhan lele dumbo *Clarias gariepinus* yang dipelihara dengan padat penebaran tinggi. Jurnal Akuakultur Indonesia. 16(2): 244-252.
- Strycharz-Dudziak, M., M. Kielczykowska, B. Drop, L. Swiatek, E. Kliszczewska, I. Musik, and M. Polz-Dacewickz. 2019. Total antioxidant status (TAS) superoxide dismutase (SOD), and glutathione peroxidase (GPx) in oropharyngeal cancer associated with ebv infection. Oxidative Medicine and Cellular Longevity 2019: 1-15.
- Sumardi, C.N. Ekowati, K. Handayani, dan Nurhayati. 2012. Isolasi dan karakterisasi *Bacillus* sp. penghasil antimikroba dari saluran pencernaan ayam kampung (*Gallus domesticus*). Universitas Lampung. Prosiding SNSMAIP III-2012.
- Susanti F.I. and E. Retnaningrum. 2017. Phenotypic identification and numerical taxonomy of pigmented bacteria isolated from marine and freshwater aquatic at Yogyakarta, Indonesia. Proceeding the 3rd Conference of Science and Technology. 1: 25-30.
- Susanto, H. 1986. Budidaya Ikan Lele. Kanisius, Yogyakarta.
- Syawal, H., I. Effendi, dan R. Kurniawan. 2021. Perbaikan profil hematologi ikan patin (*Pangasius hypophthalmus*) setelah penambahan suplemen herbal pada pakan. Jurnal Veteriner 22(1): 16-25.
- Talpur, A.D., M.B. Munir, A. Mary, and R. Hashim. 2014. Dietary probiotics and prebiotics improved food acceptability, growth performance, haematology and immunological parameters and diseases resistance against *Aeromonas hydrophila* in snakehead (*Channa striata*) fingerlings. Aquaculture. 426: 14-20.



- Tambekar, D.H. and S.A. Bhutada. 2010. An evaluation of probiotic potential of *Lactobacillus* sp. from milk of domestic animals and commercial available probiotic preparations in prevention of enteric bacterial infections. *Recent Research Science and Technology*. 2: 82-88.
- Tan, B.L., M.E. Norhaizan, W.P.P. Liew, and H.S. Rahman. 2018. Antioxidants and oxidative stress: A mutual interplay in age-related diseases. *Frontiers in Pharmacology*. 9: 1-28.
- Thurlow, C.M., M.A. Williams, A. Carrias, C. Ran, M. Newman, J. Tweedie, E. Allison, L.N. Jescovitch, A.E. Wilson, J.S. Terhune, and M.R. Liles. 2019. *Bacillus velezensis* AP193 exerts probiotic effects in channel catfish (*Ictalurus punctatus*) and reduces aquaculture pond eutrophication. *Aquaculture*. 503: 347-356.
- Tinh, N.T.N., K. Dierckens, P. Sorgeloos, and P. Bossier. 2007. A review of the functionality of probiotics in the larviculture food chain. *Mar Biotechnol*. 10: 1-12.
- Titrawani. 2014. Gambaran darah ikan paweh (*Osteochilus hasselti* C.V.) dari danau lubuk siam, kecamatan siak hulu, kabupaten Kampar. *Jurnal Biologi* 7(1): 28-34.
- Umaru, J. and M.O. Agbugui. 2021. Influence of Antox® probiotic, as water additive in growth performance, nutrient utilization and body consumption of the African catfish, *Clarias gariepinus* (BURCHEL, 1882) fingerlings. *Bayero J. Pure Appl.* 14(2): 178-183.
- Utami, D. T., S. B. Prayitno, S. Hastuti, and A. Santika. 2013. Gambaran parameter hematologis pada Ikan Nila (*Oreochromis niloticus*) yang diberi vaksin DNA *Streptococcus iniae* dengan dosis yang berbeda. *Microbiology Indonesia*. 2 (4): 7-20
- Wardani, B.A., R. Sari, dan Sarjito. 2013. Inventarisasi bakteri yang berpotensi sebagai probiotik dari usus Bandeng (*Chanos chanos*). *Journal of Aquaculture Management and Technology*. 2(1): 75-86.
- Wientarsih, I., S.D. Widhyari, dan T. Aryanti. 2012. Kombinasi imbuhan herbal kunyit dan zink dalam pakan sebagai alternatif perobatan kolibasilosis pada ayam pedaging. *Jurnal Veteriner* 14(3): 327-334.
- Winarsi, H., S.P.M. Wijayanti, dan A. Purwanto. 2012. Aktivitas enzim superoksid dismutase, katalase, dan glutation peroksidase Wanita penderita sindrom metabolic. *Majalah Kedokteran Bandung*. 4(1): 8-12.
- Yan, Y., Y. Li, Z. Zhang, X. Wang, Y. Niu, S. Zhang, W. Xu, and C. Ren. 2021. Advances of peptides for antibacterial applications. *Colloids Surf. B Biointerfaces*. 202: 1-23.
- Yu, J., Y. Song, Y. Ren, Y. Qing, W. Liu, and Z. Sun. 2017. Genome-level comparisons provide insight into the phylogeny and metabolic diversity of species within the genus *Lactococcus*. *BMC Microbiology*. 17: 1-10.



Yu, M.C., Z.J. Li, H.Z. Lin, G.L. Wen, and S. Ma. 2009. Effects of dietary medicinal herbs and *Bacillus* survival, growth, body composition, and digestive enzyme activity of the white shrimp *Litopenaeus vannamei*. Aquaculture International. 17: 377-384.

Yukhimenko, L., N. Pimenov, S. Pozyabin, R. Ivannikova, E. Smirnova, I. Tkacheva, M. Odabashyan, A. Vershinina, and S. Zolotov. 2022. Effect of probiotics Zoonorm and Subalin on the immunophysiological system and microbiocenosis of carp. INTERAGOMASH. 363: 1-11.

Zhang, B., Y.N. Li, Y. Fei, and Y. Cheng. 2021. Novel pathway for vanadium(V) biode detoxification by gram-positive *Lactococcus raffinolactis*. Environmental Science and Technology. 55: 2121-2131.

Zhang, S., Z. Wang, and H. Wang. 2013. Maternal immunity in fish. Developmental and Comparative Immunology. 39: 72-78.

Zhang, Y.A., I. Salinas, and S.J. Oriol. 2011. Recent findings on the structure and function of teleost IgT. Fish Shellfish Immunol. 31: 627-634.

Zhou, S., D. Song, X. Zhou, X. Mao, X. Zhou, S. Wang, J. Wei, Y. Huang, W. Wang, S.M. Xiao, and Q. Qin. 2019. Characterization of *Bacillus subtilis* from gastrointestinal tract of hybrid hulong grouper (*Epinephelus fuscoguttatus* E. lanceolatus) and its effects as probiotic additives. Fish Shellfish Immunol. 84: 1115-1124.

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.

Zwollo, P., S. Cole, E. Bromage, and S. Kaattari. 2005. B cell heterogeneity in the teleost kidney: evidence for a maturation gradient from anterior to posterior kidney. Journal Immunol 174: 6608-6616.