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Kata kunci bersumber dari artikel. Lembar abstrak dapat dicuplik tanpa izin dan biaya

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Induksi hormonal pada *sex reversal* udang galah (*Macrobrachium rosenbergii*) menggunakan ekstrak serbuk sari pinus (*Pinus tabulaeformis*)

Hormonal induction of sex reversal in giant freshwater prawn (Macrobrachium rosenbergii) using pine (Pinus tabulaeformis) pollen extract

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Udang galah (*Macrobrachium rosenbergii*) merupakan komoditas perikanan air tawar yang memiliki ciri dimorfisme seksual pada pertumbuhan individu jantan lebih cepat dibanding betina. Pembentukan populasi monoseks jantan potensial dalam budidaya bertujuan untuk meningkatkan keseragaman, memacu pertumbuhan, dan efisiensi produksi. Induksi *sex reversal* pada pembentukan individu *neomale* dapat dilakukan secara hormonal menggunakan bahan yang mengandung derivat testosteron, yaitu serbuk sari pinus (*Pinus tabulaeformis*). Penelitian ini bertujuan untuk mengevaluasi efektivitas ekstrak serbuk sari pinus terhadap performa *sex reversal* pada udang galah. Ekstrak serbuk sari pinus dengan dosis berbeda (0,0 mL L⁻¹; 0,2 mL L⁻¹; 0,4 mL L⁻¹; dan 0,6 mL L⁻¹) diberikan melalui perendaman selama 24 jam pada larva udang galah sebelum berdiferensiasi kelamin (PL15) berukuran panjang 12 ± 0,3 mm dan bobot 0,02 ± 0,001 g dengan kepadatan 60 individu per L, kemudian dipelihara selama 45 hari dalam kontainer (60 x 40 x 30 cm³) dengan tinggi air 20 cm dan kepadatan 1 individu per L. Perlakuan dosis ekstrak serbuk sari pinus dosis 0,2 mL L⁻¹ menghasilkan nisbah kelamin jantan 46,69 ± 5,36%, sedangkan peningkatan dosis 0,4-0,6 mL L⁻¹ dan kontrol tidak efektif mengarahkan kelamin jantan (35-42%) dengan tingkat kelangsungan hidup udang PL60 berkisar 66-82%. Ciri kelamin sekunder udang galah jantan PL60 berukuran 30-32 mm berupa male gonopore (MG) dan appendix masculine (AM), sedangkan betina memiliki appendix interna (AI) pada kaki renang kedua dan rongga di antara kedua kaki jalan kelima. Aplikasi ekstrak serbuk sari pinus pada dosis maksimal 0,2 mL L⁻¹ dapat mengarahkan kelamin jantan udang galah.

KATA KUNCI: dimorfisme; neomale; pertumbuhan; pinus; udang galah

Giant freshwater prawn (Macrobrachium rosenbergii) is a freshwater fishery commodity with sexual dimorphism in which male individuals grow faster than females. The establishment of a male monosexual population is expected to increase individual uniformity, growth rate, and production efficiency. Induction of sex reversal in the formation of the pseudomale can be done hormonally using materials containing testosterone derivatives, for example, pine pollen (Pinus tabulaeformis). This study aimed to evaluate the effectiveness of pine pollen extract on the sex reversal performance of giant prawns. Pine pollen extract with different doses (0.0 mL L⁻¹; 0.2 mL L⁻¹; 0.4 mL L⁻¹; and 0.6 mL L⁻¹) was given by immersion during 24 hours in prawns before sexual differentiation (PL15) with a length of 12 ± 0.3 mm and a weight of 0.02 ± 0.001 g with a density of 60 individuals per L, then reared for 45 days in a container (60 x 40 x 30 cm³) with a water height of 20 cm and a density of 1 individual per L. Treatment with a dose of pine pollen extract at a dose of 0.2 mL L⁻¹ resulted in a male sex ratio of 46.69 ± 5.36%, while increasing doses of 0.4-0.6 mL L⁻¹ and the control were not effective in the sex reversal (35-42%) with a survival rate of PL60 ranged from 66-82%. The secondary sexual characteristics of PL60 male giant prawns measuring 30-32 mm are male gonopore (MG) and masculine appendix (AM), while female giant prawns have an internal appendix (AI) on the second swimming leg and the cavity between the fifth swimming leg. This study concludes that the application of pine pollen extract at a maximum dose of 0.2 mL L⁻¹ could directly induced sex reversal of female to male of giant prawns.

KEYWORDS: dimorphism; freshwater prawns; growth; neomale; pine pollen

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Pemanfaatan minyak cengkeh sebagai bahan anastesi untuk transportasi ikan tambakan (*Helostoma temminckii*)

*The use of clove oil as an anesthetic agent for the transportation of kissing gourami (*Helostoma temminckii*)*

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Minyak cengkeh telah banyak digunakan oleh pembudidaya sebagai anastesi pada transportasi ikan. Akan tetapi penggunaannya pada beberapa jenis ikan dengan kepadatan yang berbeda menunjukkan kebutuhan dosis penggunaan yang berbeda. Tujuan penelitian ini adalah untuk menentukan dosis minyak cengkeh sebagai bahan pembius ikan tambakan (*Helostoma temminckii*) dan untuk mengetahui pengaruh pemberian minyak cengkeh pada transportasi ikan tambakan. Penelitian ini membandingkan kondisi transportasi yang menggunakan minyak cengkeh dan tanpa minyak cengkeh (kontrol) dengan kepadatan berbeda. Kepadatan yang digunakan adalah 10, 12, dan 14 ekor L⁻¹. Ikan tambakan yang digunakan berukuran 15 ± 0,5 cm. Penelitian ini dibagi menjadi dua tahap yang terdiri dari penentuan konsentrasi efektif-100 10 menit (EC100 10 min) dan pengaruh minyak cengkeh terhadap kepadatan selama 12 jam transportasi. Hasil penelitian menunjukkan bahwa nilai EC100 10 min adalah 0,026 mL L⁻¹. Sesaat setelah transportasi, tingkat kelangsungan hidup dan tingkat konsumsi oksigen tidak berbeda nyata antara perlakuan dan kontrol pada kepadatan yang berbeda. Akan tetapi kadar glukosa darah pada kepadatan 10 ekor L⁻¹ dan 12 ekor L⁻¹ lebih rendah daripada kontrol. Pemantauan kesehatan ikan setelah 7 hari pascatransportasi menunjukkan bahwa tidak ada perbedaan nyata antara kontrol dan perlakuan baik kelangsungan hidup maupun kadar glukosa darah. Oleh karena itu, pemanfaatan minyak cengkeh pada dosis 0,026 mL L⁻¹ untuk transportasi ikan tambakan dapat diaplikasikan dengan kondisi kepadatan 14 ekor L⁻¹ selama 12 jam. Pemanfaatan minyak cengkeh pada ikan tambakan perlu dilakukan kajian lebih lanjut terkait penambahan kepadatan dan waktu transportasi atau aplikasinya untuk transportasi benih ikan tambakan.

KATA KUNCI: anastesi; ikan tambakan; minyak cengkeh; transportasi ikan

*Clove oil has been widely used by farmers as an anesthetic agent in fish transportation. However, its use on several fish with different densities indicates the need for different doses. The aim of this study was to determine the dose of clove oil as an anesthetic agent for kissing gourami (*Helostoma temminckii*) and to determine the effect of administering clove oil on the transportation of kissing gourami. This study compared transportation conditions using clove oil and without clove oil (control) with different densities. The densities used were 10, 12, and 14 L⁻¹. The kissing gourami used measured 15 ± 0.5 cm. This study was divided into two stages consisting of determining the effective concentration-100 10 minutes (EC100 10 min) and the effect of clove oil on density during 12 hours of transportation. The results showed that EC100 10 min value was 0.026 mL L⁻¹. Immediately after transportation, survival rates and oxygen consumption levels were not significantly different between treatments and control at different densities. However, blood glucose levels of 10 fish L⁻¹ and 12 fish L⁻¹ were lower than the control. Fish health status monitoring after 7 days post-transportation showed that there was no significant difference between control and treatment in terms of survival rate or blood glucose levels. Therefore, the use of clove oil at a dose of 0.026 mL L⁻¹ for the transportation of kissing gourami can be applied at a density of 14 fish L⁻¹ for 12 hours. Further studies are required to determine the effects of clove oil as an anesthetic agent applied at denser stocking densities and longer transportation period of kissing gourami seeds.*

KEYWORDS: anesthesia; clove oil; fish transportation; kissing gourami

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Pengaruh penambahan *Cinnamomum burmanii* dalam pakan untuk pencegahan infeksi *Aeromonas hydrophila* pada ikan jambal siam (*Pangasius hypophthalmus*)

Effects of Cinnamomum burmanii addition in feed for preventing *Aeromonas hydrophila* infection in siamese catfish (*Pangasius hypophthalmus*)

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Motile Aeromonas septicemia (MAS) merupakan penyakit yang disebabkan oleh *Aeromonas hydrophila* dan sering menyerang ikan jambal siam (*Pangasius hypophthalmus*). Kayu manis merupakan tanaman yang memiliki senyawa aktif, seperti minyak atsiri yang mengandung *cinnamaldehyde* dan berperan sebagai antibakteri. Tujuan penelitian adalah untuk mengetahui efektifitas penambahan larutan kayu manis dalam mencegah infeksi *A. hydrophila* penyebab penyakit MAS pada ikan jambal siam. Metode yang digunakan adalah metode eksperimen dengan rancangan acak lengkap (RAL), lima perlakuan dan tiga ulangan. Perlakuan yang diterapkan adalah sebagai berikut: Kn (kontrol negatif), Kp (kontrol positif), dan (P1; P2; dan P3 penambahan larutan kulit kayu manis dengan dosis 15; 30; dan 45 mL kg⁻¹ pakan). Ikan (10 ± 2 cm) dipelihara dalam akuarium berukuran 40 x 30 x 30 cm³ dengan kepadatan 10 ekor per akuarium. Pada hari ke-32 pemeliharaan, ikan diuji tantang dengan menginfeksi *A. hydrophila* sebanyak 0,1 mL per ekor dengan kepadatan 108 CFU mL⁻¹ yang dilakukan secara intramuskular. Ikan dipelihara selama 14 hari hingga hari ke-46. Parameter yang diamati adalah kadar kalsium, magnesium, dan fosfor dalam serum darah, aktivitas lisozim, tingkat kelulushidupan, dan *relative percent survival* 91,07 ± 7,78%. Hasil penelitian menunjukkan bahwa penambahan larutan kayu manis yang terbaik adalah dosis 30 mL kg⁻¹ pakan yang ditandai dengan angka kelulushidupan pascauji tantang (93,33%) dan profil biokimia darah (kadar kalsium 9,33 mg dL⁻¹, magnesium 3,10 mg dL⁻¹, dan fosfor 3,93 mg dL⁻¹) serta aktivitas lisozim (285 unit mL⁻¹) tertinggi. Hal ini menunjukkan bahwa penambahan larutan kulit kayu manis pada pakan efektif untuk mencegah penyakit MAS pada ikan jambal siam.

KATA KUNCI: *Aeromonas hydrophila*; kayu manis; lisozim; mineral

Motile Aeromonas septicemia (MAS) is a disease caused by *Aeromonas hydrophila* and often attacks Siamese catfish (*Pangasius hypophthalmus*). Cinnamon is a plant that has active compounds, such as essential oil which contains *cinnamaldehyde* and acts as an antibacterial. The aim of this study was to determine the effectiveness of cinnamon solution addition in preventing *A. hydrophila* infection which causes MAS disease in Siamese catfish. The study used an experimental trial consisting of five treatments with three replicates arranged in a completely randomized design (CRD), five treatments and three replications. The treatments applied were as follows: Nc (negative control), Pc (positive control), and (P1; P2; and P3 cinnamon bark solution addition at doses of 15; 30; and 45 mL kg⁻¹ feed). Fish (10 ± 2 cm) were reared in aquariums with a dimension of 40 x 30 x 30 cm³ at a density of 10 fish per aquarium. On the 32nd day of rearing, each fish were challenged with *A. hydrophila* through the injection of 0.1 mL solution containing *A. hydrophila* at a density of 108 CFU mL⁻¹ through intramuscular route. The fish were reared for 14 days until the 46th day. The parameters observed were levels of calcium, magnesium and phosphorus in blood serum, lysozyme activity, survival rate, and relative percent survival 91.07 ± 7.78%. The results of the study showed that the best addition of cinnamon solution was a dose of 30 mL kg⁻¹ feed, which was characterized by better post-challenge survival rate (93.33%) and blood biochemical profile (calcium level 9.33 mg dL⁻¹, magnesium 3.10 mg dL⁻¹, and phosphorus 3.93 mg dL⁻¹) and the highest lysozyme activity (285 units mL⁻¹). These findings showed that the addition of cinnamon bark solution to feed was effective in preventing MAS disease in Siamese catfish.

KEYWORDS: *Aeromonas hydrophila*; cinnamon; lysozyme; mineral

Kata kunci bersumber dari artikel. Lembar abstrak dapat dicuplik tanpa izin dan biaya

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Hubungan produktivitas primer dengan tingkat produksi tambak polikultur rumput laut dengan udang dan ikan bandeng: studi kasus di Brebes, Jawa Tengah, Indonesia

The relationship of primary productivity with the production level of seaweed polyculture ponds with shrimp and milkfish: a case study in Brebes, Central Java, Indonesia

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Produktivitas tambak dipengaruhi oleh produktivitas primer yang tergantung dari kesetimbangan dinamika suhu, salinitas, kandungan oksigen, fosfat, dan nitrat. Nilai produktivitas primer yang tinggi meningkatkan daya dukung lingkungan bagi pertumbuhan rumput laut, ikan bandeng, dan udang. Tujuan dari penelitian ini adalah untuk mengetahui hubungan produktivitas primer terhadap produksi tambak polikultur dan membandingkan hasil produksi *Gracilaria* sp. pada tambak polikultur rumput laut dengan udang (RLU) dan rumput laut dengan ikan bandeng (RLB). Observasi selama 4 bulan dilakukan pada 10 tambak RLU dan 10 tambak RLB di Desa Randusanga Wetan, Kabupaten Brebes. Padat tebar ikan bandeng adalah 1-2 ekor m⁻², udang windu 10 ekor m⁻², dan rumput laut adalah 1 ton ha⁻¹. Dosis pakan udang 2% bobot tubuh per hari, sedangkan ikan bandeng hanya mengandalkan pakan alami berupa klekap yang tumbuh di tambak. Nilai produktivitas primer pada tambak RLB (112,17 ± 41,06 mgC m⁻³ hari⁻¹) dan RLU (105,39 ± 29,12 mgC m⁻³ hari⁻¹) tidak menunjukkan perbedaan yang signifikan (P<0,05). Hubungan produktivitas primer dengan produksi *Gracilaria* sp. adalah cukup kuat, yaitu 76% pada polikultur dengan ikan bandeng, dan 61% pada polikultur dengan udang. Namun, korelasi produktivitas primer terhadap produksi ikan bandeng dan udang windu memiliki hubungan yang rendah (10%). Tambak RLB menghasilkan produksi *Gracilaria* sp. lebih tinggi (8.885 kg ha⁻¹ siklus⁻¹) dibandingkan dengan tambak RLU (7.203 kg ha⁻¹ siklus⁻¹). Pada budidaya polikultur dengan rumput laut, produksi ikan bandeng adalah 688 kg ha⁻¹ siklus⁻¹, dan produksi udang yaitu 593 kg ha⁻¹ siklus⁻¹. Produktivitas primer yang tinggi pada tambak polikultur rumput laut dengan ikan bandeng menghasilkan produksi *Gracilaria* sp. yang lebih tinggi dibanding tambak polikultur rumput laut dengan udang.

KATA KUNCI: *Gracilaria* sp.; polikultur; produksi tambak; produktivitas primer

*Pond productivity is influenced by primary productivity, which depends on the dynamic balance of temperature, salinity, oxygen, phosphate, and nitrate content. High primary productivity values increase the environmental carrying capacity for the growth of seaweed, milkfish, and shrimp. The aims of this study were to determine the relationship between primary productivity and production in polyculture ponds and compare the production results of *Gracilaria* sp. in polyculture ponds of seaweed with shrimp (RLU) and seaweed with milkfish (RLB). Observations were carried out during 4 months at 10 RLU ponds and 10 RLB ponds in Randusanga Wetan Village, Brebes Regency. The stocking density for was 1-2 fish m⁻² for milkfish, 10 shrimp m⁻² for tiger prawns and 1 ton ha⁻¹ for seaweed. The feed dose for shrimp was 2% of body weight per day, while milkfish only rely on natural food in the form of microphytobenthos available in the ponds. The primary productivity values in RLB ponds (112.17 ± 41.06 mgC m⁻³ day⁻¹) and RLU (105.39 ± 29.12 mgC m⁻³ day⁻¹) did not show significant differences (P<0.05). The correlation between primary productivity and *Gracilaria* sp. production is quite strong, which is 76% in polyculture with milkfish, and 61% in polyculture with shrimp. However, the correlation between primary productivity and milkfish and tiger prawn production is low (10%). The RLB ponds produced higher quantity of *Gracilaria* sp. (8,885 kg ha⁻¹ cycle⁻¹) compared to RLU ponds (7,203 kg ha⁻¹ cycle⁻¹). In polyculture with seaweed, milkfish production was 688 kg ha⁻¹ cycle⁻¹, and production of shrimp was 593 kg ha⁻¹ cycle⁻¹. High primary productivity in polyculture ponds of seaweed and milkfish resulted in a higher production of *Gracilaria* sp. compared to that of seaweed and shrimp polyculture ponds.*

KEYWORDS: *Gracilaria* sp.; polyculture; pond production; primary productivity

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Peningkatan pertumbuhan mikroalga *Chaetoceros ceratosporum* dan *Nannochloropsis oculata* menggunakan *strain* bakteri terseleksi pada kultur skala terkontrol

Growth enhancement of microalgae Chaetoceros ceratosporum and Nannochloropsis oculata using selected bacterial strains in controlled culture environments

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Sejalan dengan peningkatan produksi budidaya perikanan, maka diperlukan intensifikasi produksi benih ikan atau udang. Di antara permasalahan yang dihadapi pembenih adalah ketersediaan pakan alami (*microalgae*) yang memadai dan kontinu baik kualitas maupun kuantitas selama pemeliharaan larva. Upaya meningkatkan produksi mikroalga melalui pendekatan hubungan koeksistensi dan pemacuan pertumbuhan dengan memanfaatkan peran bakteri yang menguntungkan perlu dilakukan. Tujuan penelitian ini adalah untuk mendapatkan dan mengetahui efektivitas *strain* bakteri terseleksi yang mempunyai kemampuan menstimulasi pertumbuhan dalam meningkatkan pertumbuhan mikroalga pada kultur skala terkontrol. Pada penelitian ini digunakan mikroalga *Chaetoceros ceratosporum* dan *Nannochloropsis oculata*. Bakteri yang berasosiasi dalam kultur tersebut diisolasi, dilakukan *screening*, uji aktivitas sintesis enzimatis, karakterisasi, identifikasi, kultur, dan re-inokulasi pada kultur mikroalga. Hasil yang diperoleh ada tujuh isolat bakteri dari *C. ceratosporum* dan delapan isolat dari *N. oculata*. Hasil uji aktivitas sintesis enzimatis ternyata hanya ada satu *strain* (kode CC-22) pada *C. ceratosporum* dan dua *strain* pada *N. oculata* (kode NN-5 dan NN-6) yang potensial menunjukkan peran stimulasi pertumbuhan mikroalga. Dengan pendekatan karakterisasi molekuler menggunakan 16SrRNA maka diperoleh *Marinobacter vinifirmus* CC22, *Alteromonas* sp. NN-5, dan *Marinobacter hydrocarbonoclastic* NN-6. Dari tiga *strain* bakteri yang terisolasi nampaknya hanya *Marinobacter vinifirmus* CC22 dan *Alteromonas* sp. NN-5 yang mempunyai sifat dapat memacu pertumbuhan *C. ceratosporum* sebesar 1,76 kali (176 %) dan *N. oculata* sebesar 1,56 kali (156 %) dibandingkan dengan kontrol. Kedua *strain* bakteri ini menunjukkan potensi untuk meningkatkan kuantitas dan kualitas mikroalga serta berpeluang sebagai *probiotic agent* untuk menstimulasi pertumbuhan *C. ceratosporum* dan *N. oculata*.

KATA KUNCI: *Chaetoceros ceratosporum*; mikroalga; *Nannochloropsis oculata*; pertumbuhan; *strain* bakteri

The intensification of fish and shrimp seed production is necessitated to support the ever growing global aquaculture production. One of the problems faced by most hatcheries is the unavailability of high quality and stable supply of live feed (microalgae) required during larval rearing. Efforts to increase microalgae production through a coexistence relationship approach and promoting growth by utilizing the role of beneficial bacteria need to be carried out. The aims of this study were to obtain and determine the effectiveness of selected bacterial strains that have the ability to stimulate microalgae growth in controlled culture environments. In this study, the microalgae Chaetoceros ceratosporum and Nannochloropsis oculata were used. Bacteria associated in the culture were isolated, screened, tested for enzymatic synthesis activity, characterization, identification, culture, and re-inoculation on microalgal cultures. The results obtained were seven bacterial isolates from C. ceratosporum and eight isolates from N. oculata. The results of the enzymatic synthesis activity test showed that there was only one strain (code CC-22) in C. ceratosporum and two strains in N. oculata (codes NN-5 and NN-6) which potentially showed a role in stimulating microalgae growth. With a molecular characterization approach using 16SrRNA, Marinobacter vinifirmus CC22, Alteromonas sp. NN-5, and Marinobacter hydrocarbonoclastic NN-6. From the three isolated bacterial strains, it appeared that only Marinobacter vinifirmus CC22 and Alteromonas sp. NN-5 had the property of being able to stimulate the growth of C. ceratosporum by 1.76 times (176%) and N. oculata by 1.56 times (156%) compared to the control. These two bacterial strains showed the potential to increase the quantity and quality of microalgae and had the opportunity to act as probiotic agents to stimulate the growth of C. ceratosporum and N. oculata.

KEYWORDS: bacterial strain; *Chaetoceros ceratosporum*; growth; microalgae; *Nannochloropsis oculata*

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Minireview on sustainable antivirulence strategy for aquaculture

Reviu mini strategi antivirulensi berkelanjutan untuk akuakultur

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The increasing occurrence of antibiotic-resistant bacteria is one of the major challenges currently faced by the aquaculture sector. Ineffective applications of antibiotics to treat bacterial diseases, leading to the need for alternative strategies to address the problem. The antivirulence approach is a highly promising strategy that aims to stop pathogenic bacteria from causing harm to the host by disrupting their virulence mechanisms. This approach involves understanding the mechanisms of bacterial pathogenicity that can be developed into new therapeutic methods. There have been numerous advancements in combating bacterial infections, such as disrupting host-pathogen communication and inhibiting quorum sensing (QS). Antivirulence therapy offers a significant advantage as it specifically targets bacterial virulence without imposing excessive pressure on bacterial growth, reducing the risk of resistance development. This review outlines the limitations of antibiotic use and presents current insights into bacterial pathogenicity mechanisms and antivirulence strategies in aquaculture. It particularly highlights the impact of host-pathogen signaling via catecholamines, stress hormones, and QS mechanisms in certain aquaculture-pathogenic bacteria. The influence of host stress hormones on pathogen growth and virulence is noteworthy. Quorum sensing (QS) is known to regulate the expression of certain virulence genes in response to bacterial density by releasing and detecting a small signal molecule called autoinducers. This review further explains various strategies to interfere with QS mechanisms, including inhibiting signal molecule biosynthesis, using QS antagonists, chemical inactivation, or biodegradation of QS signals. These promising strategies have been considered as the first step and proof of concept of antivirulence strategies to prevent disease outbreaks in aquaculture.

KEYWORDS: antibiotic resistant; quorum quenching; quorum sensing; vibriosis; virulence factors

Meningkatnya jumlah bakteri yang resisten terhadap antibiotik merupakan salah satu tantangan besar yang saat ini dihadapi oleh sektor akuakultur. Penerapan antibiotik yang tidak efektif untuk mengobati penyakit bakterial, menyebabkan perlunya strategi alternatif untuk mengatasi masalah tersebut. Pendekatan antivirulensi adalah strategi yang sangat menjanjikan yang bertujuan untuk menghentikan bakteri patogen dalam menyebabkan kerusakan pada inang dengan mengganggu mekanisme virulensinya. Pendekatan ini melibatkan pemahaman mekanisme patogenitas bakteri yang dapat dikembangkan menjadi metode terapi baru. Terdapat banyak perkembangan dalam melawan infeksi bakteri, seperti mengganggu komunikasi inang-patogen dan menghambat quorum sensing (QS). Terapi antivirulensi menawarkan keuntungan yang signifikan karena secara spesifik menargetkan virulensi bakteri tanpa memberikan tekanan berlebihan pada pertumbuhan bakteri, sehingga mengurangi risiko berkembangnya resistensi. Reviu ini menguraikan keterbatasan penggunaan antibiotik dan menyajikan wawasan terkini mengenai mekanisme patogenitas bakteri dan strategi antivirulensi dalam budidaya perikanan. Reviu ini terutama menyoroti dampak sinyal patogen inang melalui katekolamin, hormon stres, dan mekanisme QS pada bakteri patogen tertentu dalam akuakultur. Pengaruh hormon stres inang terhadap pertumbuhan dan virulensi patogen patut diperhatikan. Quorum sensing (QS) diketahui mengatur ekspresi gen virulensi tertentu sebagai respons terhadap kepadatan bakteri dengan melepaskan dan mendeteksi molekul sinyal kecil yang disebut autoinduser. Reviu ini lebih lanjut menjelaskan berbagai strategi untuk mengganggu mekanisme QS, termasuk menghambat biosintesis molekul sinyal, menggunakan antagonis QS, inaktivasi kimia, atau biodegradasi sinyal QS. Strategi yang menjanjikan ini telah dianggap sebagai langkah pertama dan bukti dari konsep strategi antivirulensi untuk mencegah wabah penyakit pada budidaya perikanan.

KATA KUNCI: faktor virulensi; quorum quenching; quorum sensing; resisten antibiotik; vibriosis

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AUTHOR GUIDELINES OF JURNAL RISET AKUAKULTUR FOR WRITING FORMAT AND PUBLICATION PROCESS

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ABSTRACT

Abstract is written in bahasa and English using 12-point Times New Roman single space with justified alignment. English abstract is followed by the English version of the title which is typed using bold capitalized each word letters. Abstract must not exceed than 250 words and contains the brief outline of the problem statement and aims of the study, brief methodology, the main findings or results, and conclusion.

KEYWORDS: author guidelines; Jurnal Riset Akuakultur; publication process; writing format

ABSTRAK: *Panduan Format Penulisan Jurnal Riset Akuakultur (Terjemahan dari Judul Artikel yang ditulis dalam Bahasa Indonesia Maksimal 20 Kata)*

Abstrak ditulis dalam bahasa Indonesia dan Inggris menggunakan font Times New Roman 12 spasi satu dengan rata kiri dan kanan. Abstrak bahasa Inggris diikuti dengan judul naskah versi bahasa Inggris yang diketik tebal dengan huruf pertama kapital pada setiap kata. Abstrak tidak boleh lebih dari 250 kata dan berisi ringkasan masalah dan tujuan penelitian, metodologi singkat, temuan utama atau hasil penelitian, dan kesimpulan.

KATA KUNCI: *format penulisan; Jurnal Riset Akuakultur; petunjuk penulisan; proses publikasi*

INTRODUCTION

Introduction must be concise and at least has several components including an adequate background related to the research, problem statement, some literature review from previous studies, the research gap, and the aims of the study. Introduction is written using double space line, single column, 12-point Times New Roman with justified alignment. Text citation of references uses author-date style according to APA 7th Edition and multiple references are listed in alphabetical order separated by semicolon among references to differentiate citations, e.g. (Smith & Jones, 2016; Williams, 2014). Use “and” when giving a citation in sentences and “&” for parentheses, e.g. Smith and Jones (2016) or (Smith & Jones, 2016).

MATERIALS AND METHODS

This section presents a clear and concise research procedures for others to be able to replicate the study. The use of subsections is allowed to explain some different continued-procedures. This section also provides ethical clearance statement for the research which applies an experiment on animals or human. The materials and equipment used must be mentioned with their specifications consisting of the trademark, supplier or manufacture name, and region or country. This section also covers a brief narration about data analysis. Methods that have been published should be summarized and completed with in-text-citation. Modified methods should be clearly described its modification from the previous cited methods. Use the international system of units (SI) or SI-derived units to express unit of measurements. Minus index is suggested being used rather than using slash (/), e.g.: mg L⁻¹, g L⁻¹, not mg/L or g/L. This section is typed in 12-point Times New Roman, double space line, a single column with justified alignment.

RESULTS AND DISCUSSION

Results and discussion must be combined in one section. The statement of the results can be summarized from the data appeared in the figures and tables. Discussion should explore the significance of the results or comparison to previous studies and represent the causal factors why and how the results were taken place, do not re-express the mentioned data in figures and tables in the form of sentences within results. Figures and tables can be placed in this section completed with cross-reference of the figures or tables stated in the text. This section is written in 12-point Times New Roman, double space line, a single column format with justified alignment.

Tables and figures must be placed within the main text, those can be placed in sections of materials and methods or results and discussion (if applicable). The preparation of tables can follow the guidance below:

1. Provide an editable form of tables, do not place any tables in the form of images.
2. The titles of tables should be consecutively numbered using Arabic numerals, please cite the tables in the text or give cross-reference of tables in the text.
3. The titles of tables are written in both in bahasa and English for the manuscript written

in bahasa, or only in English for the manuscript in English. Type the title using 12-point Times New Roman, single space with sentence case letters in justified alignment, and give hanging indent for the second and consecutive lines of the table title.

4. The body of the table is typed in 10-point Times New Roman, single space with left alignment, only column headings are typed in bold.
5. Please provide bahasa and English versions of any text in the body of the table for the manuscript submitted in bahasa, use italic font to type the English version of the text, while all the text in the table body of the manuscript submitted in English is only provided in English.
6. Use single horizontal lines to separate column heading and to indicate the end of the table, other horizontal lines are not needed. Vertical lines should not be used in the tables.
7. Capitalize only the first letter of the first word in each column and row entry.
8. All abbreviations and symbols or any statistical explanation and used literatures in the table body must be described in footnotes placed below the table and written in 10-point Times New Roman, single space in justified alignment.

An example of table format can be seen below.

Table 1. Average of survival rate, absolute weight growth, absolute length growth, and daily growth rate Asian redtail catfish fry fed different percentages of fermented sago dregs and anchovy head meal feed.

<i>Treatments</i>	<i>SR (%)</i>	<i>AWG (g)</i>	<i>ALG (cm)</i>	<i>DGR (% day⁻¹)</i>
P1	56,67 ± 22,5	0,12 ± 0,01 ^b	1,47 ± 0,39	0,57 ± 0,06 ^b
P2	58,33 ± 10,4	0,11 ± 0,01 ^b	1,42 ± 0,54	0,56 ± 0,03 ^b
P3	75,00 ± 10,0	0,16 ± 0,01 ^c	1,54 ± 0,17	0,78 ± 0,06 ^c
P4	66,67 ± 25,6	0,07 ± 0,00 ^a	1,20 ± 0,07	0,32 ± 0,01 ^a

Note: Values with different superscript letters in the same column indicate significantly different results ($P < 0,05$). P1 = Feeding with percentages of 6%, P2 = 8%, P3 = 10 %, P4 = 12% from body weight of fish fry. SR = survival rate; AWG = absolute weight growth; ALG = absolute length growth; DGR = daily growth rate.

The preparation of figures should refer the guidance below:

1. Figures should be provided in either vector art formats (Illustrator, EPS, WMF, FreeHand, CorelDraw, PowerPoint, Excel, etc.) or bitmap formats (Photoshop, TIFF, GIF, JPEG, etc.). Bitmap images should be of 300 dpi resolution. Provide an editable form of charts, not as images.

2. The titles of figures should be consecutively numbered using Arabic numerals, please cite the figures in the text or give cross-reference of figures in the text.
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4. Please provide bahasa and English versions of any text in the body of the figure for the manuscript submitted in bahasa, use italic font to type the English version of the text, while all the text in the figure body of the manuscript submitted in English is only provided in English.
5. Capitalize only the first letter of the first word in any text contained in the figure body.
6. All abbreviations and symbols or any statistical explanation and used literatures in the figure body must be described in footnotes placed below the figure title and written in 10-point Times New Roman, single space in justified alignment.

An example of figure format is presented below.

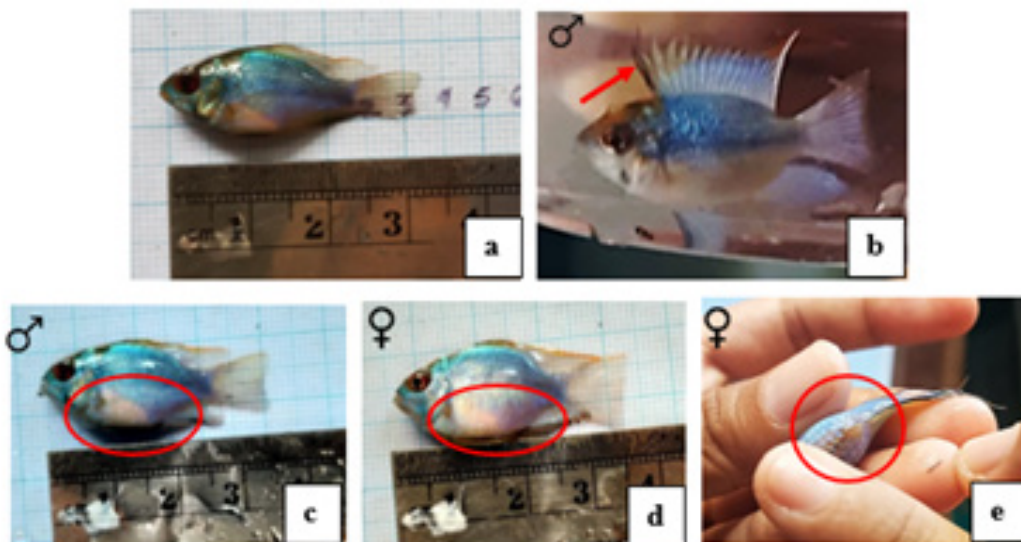


Figure 1. Visual observations of gonad matured ramirezi broodstock: (a) research start (b) ramirezi male at the end of the research with a black elongated front dorsal fin (c) ramirezi male with a bluer body and belly (d) ramirezi female with a pink belly (e) prominent and yellow urogenital.

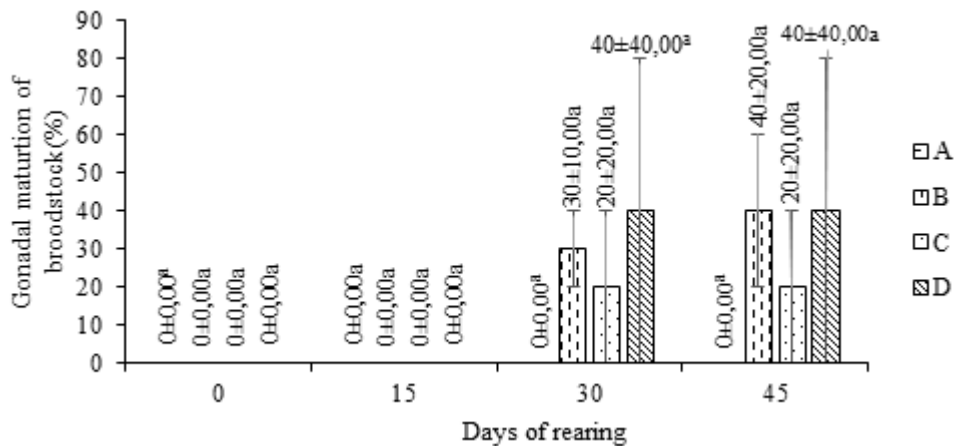


Figure 2. Accumulation percentage of gonadal mature ramirezi broodstock after treatments (combined ratio of artificial feed to bloodworms (*Chironomus* sp.): (A) 3:0, (B) 0:3, (C) 2:1, and (D) 1:2)) on day 0 to day 45

Note: The results presented are based on data normalization. Different superscripts in the same days of rearing indicate significant differences at a confidence level of 95% ($P < 0.05$).

CONCLUSION

Conclusions must summarize the results and answers the research questions or aims. Conclusions should be combined with the summary of the discussions which explains why or how the highlighted results obtained. This section is written in 12-point Times New Roman, double space line, a single column format with justified alignment.

ACKNOWLEDGMENTS

This section is used to acknowledge any institutions or individuals that provide funding sources or help during the study. The research which was funded by a research grant must mention the name of research grant and its detail such the funding organization and associated grant number (if applicable). This section is written in 12-point Times New Roman, double space line, a single column format with justified alignment.

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