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The potential use of siam weed (*Chromolaena odorata*) leaf extract as an alternative antibacterial compound to treat *Vibrio parahaemolyticus* infection in pacific white shrimp (*Litopenaeus vannamei*)

Potensi pemanfaatan ekstrak daun krinyuh sebagai senyawa antibakteri alternatif untuk mengobati infeksi ***Vibrio parahaemolyticus*** *pada udang vaname* ***(Litopenaus vannamei)***

Jurnal Riset Akuakultur, 19(3), 2024, 177-190

Siam weed plant or Siam weed (*Chromolaena odorata*) is an herb commonly used as a medicinal plant in Asian countries, including Indonesia, particularly in Southeast Sulawesi. This study explores the effectiveness of different Siam weed leaf extract concentrations in treating *Vibrio parahaemolyticus* infection in Pacific white shrimp (*Litopenaus vannamei*). In this study, the infected shrimps were soaked in *C. odorata* leaf extract solution at 1, 2, and 3 ppt concentrations and no soaking of the extract (control). The parameters measured were recovery rate, survival rate, percentage of total haemocyte count (THC) and differential haemocyte count (DHC). The results showed that the *V. parahaemolyticus*-infected Pacific white shrimps soaked in 3 ppt *C. odorata* leaf extract had the highest recovery and survival rates compared to shrimp treated with *C. odorata* leaf extract at 1 and 2 ppt. Similarly, the shrimp group treated with 3 ppt of *C. odorata* leaf extract had better haemolymph profiles than those treated with the other concentrations of *C. odorata* leaf extract. This study concludes that *C. odorata* leaf extract enhances the immune response of *L. vannamei* by increasing the activity of semi-granular cells in eliminating the pathogenic cells of *V. parahaemolyticus*.

KEYWORDS: granular cell; herb medicine; immunity; shrimp; vibriosis

*Tanaman krinyuh (**Chromolaena odorata**) merupakan tanaman herbal yang umum digunakan sebagai tanaman obat di negara-negara Asia, termasuk Indonesia, khususnya di Sulawesi Tenggara. Penelitian ini bertujuan untuk mengetahui efektivitas berbagai konsentrasi ekstrak daun tanaman krinyuh dalam mengobati infeksi **Vibrio parahaemolyticus** pada udang vaname (**Litopenaus vannamei**). Pada penelitian ini, udang yang terinfeksi direndam ke dalam larutan ekstrak daun **C. odorata** pada konsentrasi 1, 2, dan 3 ppt dan tanpa perendaman ekstrak (kontrol). Parameter yang diukur adalah tingkat kesembuhan, tingkat kelangsungan hidup, persentase jumlah hemosit total (JHT), dan jumlah hemosit diferensial (JHD). Hasil penelitian menunjukkan bahwa udang vaname yang terinfeksi **V. parahaemolyticus** yang direndam dalam ekstrak daun **C. odorata** 3 ppt memiliki tingkat kesembuhan dan kelangsungan hidup tertinggi disbanding udang yang diobati dengan ekstrak daun **C. odorata** pada konsentrasi 1 dan 2 ppt. Demikian pula, kelompok udang yang diberi 3 ppt ekstrak daun **C. odorata** memiliki profil hemolim yang lebih baik daripada yang diberi konsentrasi ekstrak daun **C. odorata** lainnya. Penelitian ini menyimpulkan bahwa ekstrak daun **C. odorata** meningkatkan respons imun **L. vannamei** dengan meningkatkan aktivitas sel semi-granular dalam menghilangkan sel patogen **V. parahaemolyticus**.*

KATA KUNCI: kekebalan tubuh; sel granular; tanaman obat; udang; vibriosis

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Growth performance, survival rate, and resistance against AHPND of *Litopenaeus vannamei* juveniles fed with synbiotic bio-encapsulated *Artemia*

Kinerja pertumbuhan, tingkat kelangsungan hidup, dan resistansi terhadap AHPND pada benih ***Litopenaeus vannamei*** *yang diberi pakan dengan* ***Artemia*** *yang dibioenkapsulasi sinbiotik*

Jurnal Riset Akuakultur, 19(3), 2024, 191-204

The whiteleg shrimp (*Litopenaeus vannamei*) is a highly valued aquaculture species globally, yet its production faces challenges due to disease outbreaks, notably acute hepatopancreatic necrosis disease (AHPND). This study aimed to evaluate the growth and survival of *L. vannamei* juveniles fed with synbiotic bio-encapsulated *Artemia* and their resilience against AHPND-causing *Vibrio parahaemolyticus* and salinity stress. The experiment employed a completely randomized design with two treatments: one with synbiotic-enriched *Artemia* (600 ppm alginate and *Lactobacillus bulgaricus*) and a control without synbiotic. Each treatment was replicated five times, using 600 juveniles at a density of 30 post-larvae per L over a 14-day rearing period. Growth and survival metrics were recorded, followed by challenge tests for AHPND and salinity shock. The juveniles' survival rate was recorded 54 hours post-infection with VpAHPND and every 10 minutes for 230 minutes after salinity exposure until 100% mortality. Results indicated higher survival (92.0 ± 9%), length gain (243.33 ± 18.80 mm), specific growth rate (18.44±2.01%), and stress tolerance in juveniles fed synbiotic encapsulated *Artemia* compared to the control. The survival rates for the challenge test with AHPND and salinity shock were similarly improved under synbiotic treatment, suggesting that synbiotics significantly benefit nursery production of *L. vannamei*. This study highlights the potential of synbiotic application in enhancing the resilience and growth of *L. vannamei* against common stressors in aquaculture, indicating its potential to support more sustainable shrimp farming practices.

KEYWORDS: salinity; shrimp; synbiotic; *Vibrio*

*Udang vaname (**Litopenaeus vannamei**) adalah komoditas budidaya bernilai tinggi di seluruh dunia, namun produksinya menghadapi tantangan akibat wabah penyakit, terutama serangan acute hepatopancreatic necrosis disease (AHPND). Penelitian ini bertujuan untuk mengevaluasi pertumbuhan dan kelangsungan hidup benih **L. vannamei** yang diberi pakan **Artemia** yang dibioenkapsulasi dengan sinbiotik serta ketahanannya terhadap **Vibrio parahaemolyticus** penyebab AHPND dan stres salinitas. Eksperimen ini menggunakan rancangan acak lengkap dengan dua perlakuan: satu dengan **Artemia** diperkaya sinbiotik (600 ppm alginat dan **Lactobacillus bulgaricus**) dan kontrol tanpa sinbiotik. Setiap perlakuan diulang lima kali, dengan menggunakan 600 ekor benih udang pada kepadatan 30 ekor pascalarva per L selama 14 hari periode pemeliharaan. Parameter pertumbuhan dan kelangsungan hidup dicatat, diikuti dengan uji tantang terhadap AHPND dan kejutan salinitas. Tingkat kelangsungan hidup benih dicatat 54 jam pasca-infeksi dengan VpAHPND dan setiap 10 menit selama 230 menit setelah paparan salinitas hingga mortalitas mencapai 100%. Hasil menunjukkan kelangsungan hidup yang lebih tinggi (92,0 ± 9%), peningkatan panjang (243,33 ± 18,80 mm), laju pertumbuhan spesifik (18,44 ± 2,01%), dan toleransi stres yang lebih baik pada benih udang yang diberi pakan **Artemia** berenkapsulasi sinbiotik dibanding kontrol. Tingkat kelangsungan hidup pada uji tantang dengan AHPND dan kejutan salinitas juga meningkat dengan perlakuan sinbiotik, menunjukkan bahwa sinbiotik memberikan manfaat signifikan pada produksi **L. vannamei** fase pendederan. Penelitian ini menunjukkan adanya potensi aplikasi sinbiotik dalam meningkatkan ketahanan dan pertumbuhan **L. vannamei** terhadap stresor umum dalam akuakultur, serta potensinya untuk mendukung kegiatan budidaya udang yang lebih berkelanjutan.*

*KATA KUNCI: salinitas; sinbiotik; udang; **Vibrio***

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Respons pertumbuhan, pemanfaatan nutrien, dan aktivitas antioksidan ikan torsoro (Tor soro) yang diberi pakan dengan suplementasi glutamin

The growth, nutrient utilization, and antioxidant activity responses of Indonesian mahseer (Tor soro) fed with glutamine-supplemented feed

Jurnal Riset Akuakultur, 19(3), 2024, 205-227

Penelitian ini bertujuan untuk mengevaluasi pengaruh suplementasi glutamin terhadap pertumbuhan dan aktivitas antioksidan pada ikan Torsoro (*Tor soro*). Ikan uji yang digunakan adalah juvenil ikan dengan berat awal rata-rata 5,21 ± 0,04 g. Perlakuan yang diberikan terdiri atas suplementasi glutamin bebas dengan dosis yang berbeda (0; 0,5; 1,0; 1,5; dan 2%) dan alanil-glutamin (0,84; 1,67; 2,51; dan 3,35%) pada pakan, setiap perlakuan memiliki lima kali ulangan. Perlakuan pakan diberikan tiga kali sehari sekenyangnya. Ikan uji dipelihara selama 60 hari. Parameter yang diamati meliputi performa pertumbuhan, pemanfaatan nutrisi, indeks biologis, dan aktivitas antioksidan. Hasil penelitian menunjukkan bahwa pakan yang disuplementasi glutamin bebas berpengaruh nyata ($p<0,05$) terhadap performa pertumbuhan, pemanfaatan nutrisi, indeks biologis, dan aktivitas antioksidan ikan uji. Hasil uji lebih lanjut menunjukkan bahwa suplementasi alanil-glutamin dalam pakan sebesar 2,51% memberikan hasil terbaik terhadap bobot akhir, laju pertumbuhan spesifik, retensi protein, rasio efisiensi protein, konversi pakan, rasio viseral somatik, rasio panjang usus, aktivitas superoksida dismutase, glutation peroksidase, dan katalase pada ikan Torsoro. Berdasarkan evaluasi keseluruhan terhadap parameter yang diamati, penelitian ini menunjukkan bahwa suplementasi alanil-glutamin dalam pakan pada tingkat 2,51% mampu meningkatkan kinerja pertumbuhan, pemanfaatan nutrisi, indeks biologis, dan aktivitas antioksidan pada ikan Torsoro.

KATA KUNCI: antioksidan; glutamin; ikan Torsoro; pertumbuhan

*This study aimed to evaluate the effects of glutamine supplementation on the growth of and antioxidant activity in Torsoro fish (**Tor soro**). The test fish used were Torsoro fish juveniles with an average initial weight of 5.21 ± 0.04 g. The treatments consisted of different supplementation levels of free glutamine (0; 0.5; 1.0; 1.5; and 2%) and alanyl-glutamine (0.84; 1.67; 2.51; and 3.35%) in feed, where each treatment had five replicates. The feed treatments were given three times a day ad satiation. The experimental fish were reared for 60 days. The parameters observed included growth performance, nutrient utilization, biological indices, and antioxidant activity. The results showed that free glutamine-supplemented feed significantly affects ($p<0.05$) the growth performance, nutrient utilization, biological indices, and antioxidant activity of the tested fish. Further test results showed that alanyl glutamine supplementation in feed at 2.51% produced the best results on the final weight, specific growth rate, protein retention, protein efficiency ratio, feed conversion, somatic visceral ratio, intestine length ratio, superoxide dismutase, glutathione peroxidase, and catalase activities of Torsoro fish. Based on the overall achievement of the observed parameters, this study determines that alanyl-glutamine supplementation in feed at 2.51% improves the growth performance, nutrient utilization, biological indices, and antioxidant activity of Torsoro fish.*

KEYWORDS: antioxidant; glutamine; growth; Torsoro

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Aplikasi arang aktif batok kelapa dan zeolit dengan filter fisik busa berbeda untuk manajemen kualitas air media budidaya ikan koi (*Cyprinus carpio*)

*Application of activated coconut shell charcoal and zeolite with different polyester filters in controlling water quality of koi fish (**Cyprinus carpio**) rearing media*

Jurnal Riset Akuakultur, 19(3), 2024, 229-242

Ikan koi (*Cyprinus carpio*) merupakan salah satu jenis ikan yang sangat sensitif terhadap perubahan kualitas air. Di sisi lain, kualitas air yang sesuai selain dapat menunjang tingkat kelangsungan hidup juga memengaruhi kecerahan warna ikan koi. Salah satu upaya untuk menjaga kualitas air tetap optimal adalah penerapan sistem resirkulasi. Tujuan dari penelitian ini adalah untuk mengetahui pengaruh penggunan bahan filter arang aktif dan zeolit yang dikombinasikan dengan filter fisik busa berbeda terhadap kualitas air media pemeliharaan ikan koi. Penelitian ini menggunakan rancangan acak lengkap yang terdiri dari empat perlakuan dan tiga ulangan yaitu: P1 (Japmat, arang aktif batok kelapa, dan zeolit), P2 (spons, arang aktif batok kelapa, dan zeolit), P3 (*biofoam*, arang aktif batok kelapa, dan zeolit), dan P4 (*greenwool*, arang aktif batok kelapa, dan zeolit). Ikan koi yang digunakan merupakan strain platinum dengan ukuran awal berkisar 6±1 cm. Hasil pengujian menunjukkan bahwa perlakuan P3 merupakan perlakuan terbaik yang secara signifikan menghasilkan nilai yang rendah ($p<0,05$) untuk kadar amonia yang berkisar 0,005-0,029 mg L^{-1} dan nilai kekeruhan antara 0,61-1,25 NTU. Nilai fisika-kimia air untuk suhu, oksigen terlarut, dan pH tidak terdapat perbedaan yang nyata ($p>0,05$) antarperlakuan dengan perbedaan filter fisik busa yang digunakan. Penggunaan filter fisik busa berupa *biofoam* (P3) secara signifikan menghasilkan performa budidaya terbaik ditinjau dari pertumbuhan bobot dan panjang mutlak masing-masing sebesar 0,48 g dan 1,40 cm, kelangsungan hidup 100% serta peningkatan kecerahan warna ikan mencapai 12,23. Studi ini menyimpulkan bahwa filter gabungan arang aktif batok kelapa dan zeolit yang dikombinasikan dengan biofoam secara efektif menyaring berbagai partikel organik dan anorganik dalam media pemeliharaan ikan koi, mengurangi kekeruhan dan meningkatkan warna serta kecerahan ikan.

KATA KUNCI: *biofoam*; *greenwool*; ikan koi; Japmat; spons

Koi fish (***Cyprinus carpio***) *is very sensitive to changes in water quality which directly influences its colour and brightness. The use of a water recirculation system could improve the control of these water quality parameters by employing specific filter materials. This research aimed to determine the effect of activated coconut shell charcoal and zeolite filter materials combined with different physical polyester filters on the water quality of the koi fish rearing media. This research used a completely randomized design consisting of four treatments and three replications, namely: P1 (Japmat, activated coconut shell charcoal, and zeolite), P2 (sponge, activated coconut shell charcoal, and zeolite), P3 (biofoam, activated coconut shell charcoal, and zeolite), and P4 (greenwool, activated coconut shell charcoal, and zeolite). The koi fish used are platinum strains with an initial size of 6±1 cm. The results showed that the P3 treatment was the best treatment, which produced significantly low values ($p<0.05$) for ammonia levels ranging from 0.005-0.029 mg L^{-1} and turbidity values between 0.61-1.25 NTU. The treatments showed no significant differences in water physicochemical values for temperature, dissolved oxygen and pH ($p>0.05$). The use of biofoam (P3) significantly resulted in the best cultivation performance in terms of absolute weight and length growth at 0.48 g and 1.40 cm, respectively, with a survival rate of 100% and increased fish color brightness at 12.23. This study concludes that the combined filters effectively filtered a wide range of organic and inorganic particulates in the rearing media of koi fish, reducing turbidity and improving the color and brightness of the fish.*

KEYWORDS: biofoam; greenwool; Japmat; koi fish; sponge

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Effect of phytase supplementation in plant-based feed on feed utilization and growth of *Pangasius hypophthalmus* during the grow-out stage

Pengaruh suplementasi enzim fitase dalam pakan berbasis tanaman terhadap pemanfaatan pakan dan pertumbuhan ***Pangasius hypophthalmus*** *selama stadia pembesaran*

Jurnal Riset Akuakultur, 19(3), 2024, 243-257

Phytic acid, found in many plant-based fish feed ingredients, is an anti-nutritional compound that binds with minerals, forming complexes that fish intestines cannot easily absorb. Adding phytase, an enzyme, to plant-based feeds has shown potential in enhancing nutrient absorption and has been effective for various aquaculture species. However, its impact on *Pangasius hypophthalmus*, a commonly farmed fish, remains underexplored. This study examines the effects of phytase on feed conversion ratio (FCR), feed utilization efficiency (EFU), protein efficiency ratio (PER), relative growth rate (RGR), and survival rate (SR) of *P. hypophthalmus*. Fish (average weight 11.55 g) were kept at a density of 40 fish m^{-3} in a fully randomized design with four treatments (0, 500, 1000, and 1500 FTU kg^{-1} feed) and three repetitions. Data on RGR, EFU, PER, FCR, SR, and water quality were analyzed. Results indicated that phytase significantly improved RGR, EFU, PER, and FCR ($P<0.05$), though SR remained unaffected. The optimal phytase dose, 738-810 FTU kg^{-1} feed, produced an EFU of 69.3% and an RGR of 4.77% per day during the grow-out stage. Water quality parameters remained stable and within optimal ranges across all treatments.

KEYWORDS: catfish; efficiency; feed; growth; phytase enzyme

Asam fitat, yang ditemukan dalam banyak bahan pakan ikan berbasis tanaman, adalah senyawa anti-nutrisi yang mengikat mineral, membentuk kompleks yang sulit diserap oleh usus ikan. Penambahan fitase, enzim, pada pakan berbasis tanaman menunjukkan potensi dalam meningkatkan penyerapan nutrisi dan telah efektif untuk berbagai komoditas budidaya. Namun, dampaknya pada ***Pangasius hypophthalmus****, ikan yang umum dibudidayakan, masih belum banyak dieksplorasi. Penelitian ini mengkaji efek fitase pada rasio konversi pakan (RKP), efisiensi pemanfaatan pakan (EPP), rasio efisiensi protein (REP), laju pertumbuhan relatif (LPR), dan tingkat kelangsungan hidup (TKH) dari P. hypophthalmus. Ikan (berat rata-rata 11,55 g) dipelihara pada kepadatan 40 ikan m^{-3} dalam rancangan acak lengkap dengan empat perlakuan (0, 500, 1000, dan 1500 FTU kg^{-1} pakan) dan tiga ulangan. Data LPR, EPP, REP, RKH, TKH, dan kualitas air dianalisis. Hasil menunjukkan bahwa fitase secara signifikan meningkatkan LPR, EPP, REP, dan RKP ($P<0,05$), meskipun berpengaruh signifikan terhadap TKH. Dosis fitase optimal, 738-810 FTU kg^{-1} pakan, menghasilkan EPP sebesar 69,3% dan LPR sebesar 4,77% per hari selama tahap pembesaran. Parameter kualitas air tetap stabil dan dalam rentang optimal di semua perlakuan.*

KATA KUNCI: efisiensi; enzim fitase; ikan patin; pakan; pertumbuhan

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Evaluasi toksisitas akut dan sub-akut dari insektisida Lambda-cyhalothrin pada ikan patin *Pangasianodon hypophthalmus*

Evaluation of acute and sub-acute toxicities of Lambda-cyhalothrin insecticide on striped catfish ***Pangasianodon hypophthalmus***

Jurnal Riset Akuakultur, 19(3), 2024, 259-275

Lambda-cyhalothrin adalah insektisida beracun yang seringkali digunakan untuk mengendalikan hama di lahan pertanian. Insektisida ini sangat beracun terhadap organisme akuatik dan berpotensi mengganggu keseimbangan metabolisme dan fisiologi ikan budidaya. Ikan patin (*Pangasianodon hypophthalmus*) merupakan salah satu jenis ikan air tawar yang sangat rentan terpapar Lambda-cyhalothrin karena letak sistem budidaya yang berdekatan dengan lahan pertanian. Penelitian ini bertujuan untuk mengetahui efek toksisitas akut Lambda-cyhalothrin dan efek sub-akut terhadap organ tubuh ikan patin. Ikan patin diperoleh dari pembudidaya ikan di Bogor, Jawa Barat, dengan berat dan panjang rata-rata 8,59 ± 0,47 g dan 7,52 ± 0,83 cm. Bahan toksikan yang digunakan adalah insektisida Lambda-cyhalothrin. Ikan yang diuji dipelihara dalam akuarium berukuran 30x30x30 cm^3 yang diisi air sebanyak 20 L. Penelitian dibagi menjadi tiga tahap, yaitu uji nilai kisaran, uji toksisitas akut LC_{50}-96 jam, dan uji sub akut. Hasil penelitian menunjukkan bahwa LC_{50}-96 jam Lambda-cyhalothrin pada ikan patin adalah 5,2 $\mu g\ L^{-1}$. Hasil uji sub akut dengan taraf perlakuan 2,6 $\mu g\ L^{-1}$ menunjukkan pertumbuhan minimal 0,688% dan berdampak nyata ($P<0,05$) terhadap kadar glukosa yang mencapai 148,16 mg dL^{-1}. Kesimpulan penelitian ini adalah Lambda-cyhalothrin bersifat merugikan terhadap ikan patin yang menyebabkan kerusakan yang nyata pada insang, usus, dan hati yang dibuktikan dengan adanya hiperplasia, proliferasi, vakuolisasi, kongesti, fusi, nekrosis, *cloudy swelling* dan inflamasi.

KATA KUNCI: glukosa; histologi; Lambda-cyhalothrin; pertumbuhan; toksisitas

*Lambda-cyhalothrin is a toxic insecticide frequently used to control pests in agricultural settings. This insecticide is very toxic to aquatic organisms and can potentially disrupt the balance of metabolism and physiology of farmed fish. Striped catfish (**Pangasianodon hypophthalmus**) is one of farmed freshwater fish species highly susceptible to being exposed to Lambda-cyhalothrin due to the common shared location of the farming system with agricultural land. This study aimed to determine the acute toxicity effects of Lambda-cyhalothrin and the sub-acute effects on the organs of the striped catfish. The striped catfish was obtained from fish farmers in Bogor, West Java, with an average weight and length of 8.59 ± 0.47 g and 7.52 ± 0.83 cm, respectively. The toxicant material used was Lambda-cyhalothrin insecticide. The tested fish were reared in aquarium sized 30x30x30 cm^3 filled with 20 L of water. This study was divided into three stages, i.e., range value test, acute toxicity test (96h-LC_{50}), and sub-acute test. The result showed that 96h-LC_{50} of Lambda-cyhalothrin on striped catfish was 5.2 $\mu g\ L^{-1}$. The results of the sub-acute test with a treatment level of 2.6 $\mu g\ L^{-1}$ showed minimal growth at 0.688% and a significant impact ($P<0.05$) on glucose levels, which reached 148.16 mg dL^{-1}. This study concludes that Lambda-cyhalothrin insecticide is detrimental to striped catfish, causing noticeable damage to the gill, intestine, and liver, as evidenced by hyperplasia, proliferation, vacuolization, congestion, fusion, necrosis, cloudy swelling, and inflammation.*

KEYWORDS: glucose; growth; histology; Lambda-cyhalothrin; toxicity

Indeks Pengarang

Author Index

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.

Treatments	*SR (%)*	*AWG (g)*	*ALG (cm)*	*DGR (% day^{-1})*
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.
3. The titles of figures 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. Place the figure title below the figure.
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.

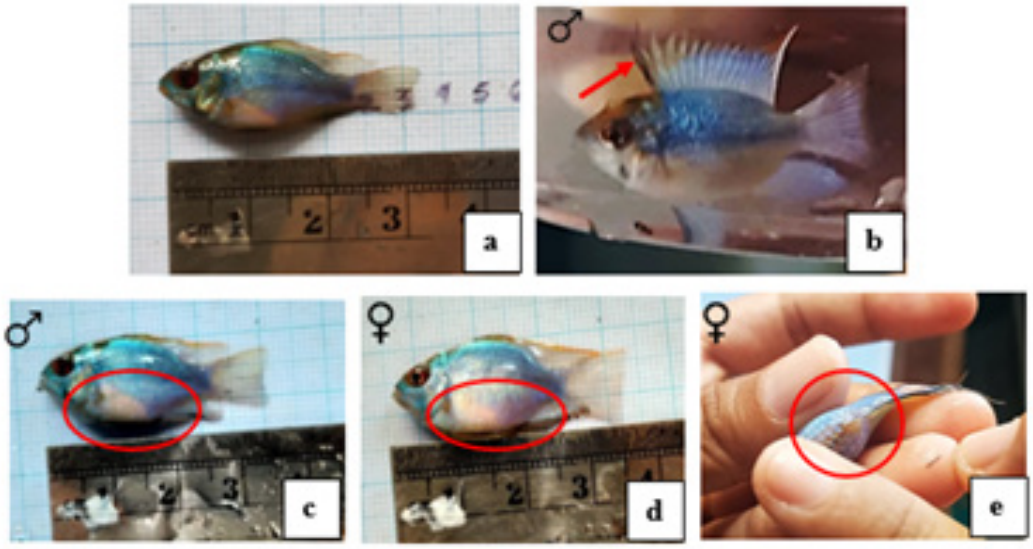

Figure 1. Visual observations of gonad matured ramirezi broodstock: (a) research start (b) ramirezi male at the end of the research with a black elongated front dorsal fin (c) ramirezi male with a bluer body and belly (d) ramirezi female with a pink belly (e) prominent and yellow urogenital.

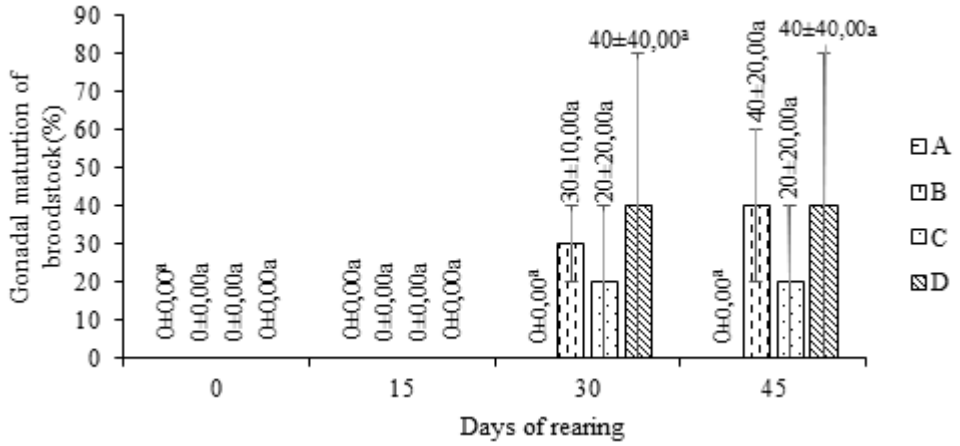

Figure 2. Accumulation percentage of gonadal mature ramirezi broodstock after treatments (combined ratio of artificial feed to bloodworms (*Chironomus* sp.): (A) 3:0, (B) 0:3, (C) 2:1, and (D) 1:2)) on day 0 to day 45

Note: The results presented are based on data normalization. Different superscripts in the same days of rearing indicate significantly 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.

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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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