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

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Efficacy of dietary supplementation of Ambon banana midrib simplicia to enhance growth performance, hematological profile, immunity, and survival of catfish challenged with *Edwardsiella tarda*

Efikasi suplementasi simplisia pelepah pisang ambon pada pakan untuk meningkatkan pertumbuhan, gambaran darah, imunitas, dan kelangsungan hidup ikan lele yang diinfeksi *Edwardsiella tarda*

Jurnal Riset Akuakultur, 20(3), 2025, 229-244

Catfish (*Clarias* sp.) is a significant aquaculture species, but its production is often limited by *Edwardsiella tarda* infections, which cause substantial losses. Plant-derived alternatives such as banana midrib simplicia offer promising solutions to enhance fish health and reduce antibiotic dependence. This study investigated the effects of Ambon banana (*Musa paradisiaca* var. *sapientum*) midrib simplicia on growth performance, hematological parameters, immune responses, and resistance to *E. tarda* infection in catfish. A completely randomized design was used with five treatments and three replications, consisting of a positive control, a negative control, and commercial feed supplemented with 2% (B2), 3% (B3), and 4% (B4) banana midrib simplicia. The feeding trial lasted 30 days, after which fish were intramuscularly injected with *E. tarda* (10^7 CFU mL⁻¹). Growth performance, hematological indicators (red blood cell count, hemoglobin concentration, hematocrit, and white blood cell count), immune responses (phagocytic and respiratory burst activities), and survival rate were evaluated. Dietary supplementation with banana midrib simplicia significantly improved growth performance, hematological parameters, immune responses, and survival in catfish challenged with *E. tarda* compared to the control groups. The optimal supplementation dose was 3%, providing the most significant improvement in growth, immunity, and survival. These findings highlight the potential of banana midrib as a functional feed additive derived from agricultural by-products to promote fish health and aquaculture productivity.

KEYWORDS: banana midrib; *Clarias* sp.; *Edwardsiella tarda*; growth performance; immune response

Ikan lele (*Clarias* sp.) merupakan salah satu komoditas penting dalam akuakultur, namun produksinya sering terkendala oleh infeksi *Edwardsiella tarda* yang menyebabkan kerugian signifikan. Alternatif berbasis tanaman seperti simplisia pelepah pisang menawarkan solusi potensial untuk meningkatkan kesehatan ikan dan mengurangi ketergantungan terhadap antibiotik. Penelitian ini mengevaluasi pengaruh simplisia pelepah pisang Ambon (*Musa paradisiaca* var. *sapientum*) terhadap kinerja pertumbuhan, parameter hematologis, respons imun, dan ketahanan terhadap infeksi *E. tarda* pada ikan lele. Penelitian ini menggunakan rancangan acak lengkap dengan lima perlakuan dan tiga ulangan, terdiri atas kontrol positif, kontrol negatif, serta pakan komersial yang disuplementasi simplisia pelepah pisang pada dosis 2% (B2), 3% (B3), dan 4% (B4). Uji pemberian pakan dilakukan selama 30 hari, kemudian ikan diinjeksi intramuskular dengan *E. tarda* (10^7 CFU mL⁻¹). Parameter yang diamati meliputi pertumbuhan, indikator hematologis (jumlah eritrosit, konsentrasi hemoglobin, hematokrit, dan jumlah leukosit), respons imun (aktivitas fagositosis dan respiratory burst), serta tingkat kelangsungan hidup. Suplementasi pakan dengan simplisia pelepah pisang secara signifikan meningkatkan performa pertumbuhan, parameter hematologis, respons imun, dan kelangsungan hidup ikan lele yang diinfeksi *E. tarda* dibanding kelompok kontrol. Dosis optimal diperoleh pada suplementasi 3%, yang memberikan peningkatan terbesar pada pertumbuhan, imunitas, dan kelangsungan hidup. Temuan ini menunjukkan bahwa simplisia pelepah pisang memiliki potensi sebagai aditif pakan fungsional berbasis limbah pertanian untuk meningkatkan kesehatan ikan dan produktivitas akuakultur.

KATA KUNCI: *Clarias* sp.; *Edwardsiella tarda*; kinerja pertumbuhan; pelepah pisang; respons imun

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Phytochemical screening and antibacterial activity of *Tengkawang Bukit* (*Shorea beccariana*) stem extract against *Vibrio parahaemolyticus*

Skrining fitokimia dan uji aktivitas antibakteri pada ekstrak batang *Tengkawang Bukit* (*Shorea beccariana*) terhadap *Vibrio parahaemolyticus*

Jurnal Riset Akuakultur, 20(3), 2025, 245-255

Vibrio parahaemolyticus infection poses a significant challenge in intensive shrimp culture, leading to substantial economic losses. Its common treatments using synthetic antibiotics have been linked to increased risks of antibiotic resistance and residual effects. Therefore, finding environmentally safe and effective natural alternatives is deemed essential. *Tengkawang Bukit* (*Shorea beccariana*) stem extract contains antibacterial compounds, including asiatic acid, oleanolic acid, and lupanone, all classified as terpenoids. This study aims to evaluate the antibacterial potential of *S. beccariana* stem extract through phytochemical screening and a disc diffusion test against *V. parahaemolyticus*. The screening results confirmed the presence of bioactive compounds, including alkaloids, flavonoids, saponins, tannins, and steroids. The disc diffusion test showed an increase in the inhibition zone with increasing extract concentration, with inhibition diameters ranging from 9.04 ± 0.48 mm to 10.75 ± 0.26 mm. The 17% extract yield indicates a high availability of active compounds. These findings suggest that tengkawang bukit stem extract has potential as a natural antibacterial alternative for controlling *V. parahaemolyticus* in shrimp culture. This approach could help reduce reliance on synthetic antibiotics and promote sustainable fisheries.

KEYWORDS: antibacterial agents; plant extracts; resistance; *Shorea beccariana*; *Vibrio parahaemolyticus*

Infeksi *Vibrio parahaemolyticus* merupakan salah satu kendala utama dalam budidaya udang yang menyebabkan kerugian ekonomi signifikan. Penggunaan antibiotik sintetis sebagai pengobatan telah menimbulkan kekhawatiran terkait resistensi dan residu, sehingga diperlukan alternatif alami yang aman dan efektif. Batang tengkawang bukit (*Shorea beccariana*) diketahui mengandung senyawa antibakteri seperti asam asiatik, asam oleanolik, dan lupanon yang tergolong ke dalam senyawa terpenoid. Studi ini bertujuan untuk mengevaluasi potensi antibakteri ekstrak batang *S. beccariana* melalui skrining fitokimia dan uji difusi cakram terhadap *V. parahaemolyticus*. Hasil skrining menunjukkan adanya kandungan senyawa bioaktif berupa alkaloid, flavonoid, saponin, tanin, dan steroid. Uji difusi cakram memperlihatkan zona hambat yang meningkat seiring dengan peningkatan konsentrasi ekstrak, dengan diameter hambatan berkisar $9,04 \pm 0,48$ mm hingga $10,75 \pm 0,26$ mm. Rendemen ekstrak sebesar 17% menunjukkan ketersediaan senyawa aktif yang melimpah. Hasil riset ini mengindikasikan bahwa ekstrak batang tengkawang bukit berpotensi sebagai alternatif antibakteri alami dalam pengendalian *V. parahaemolyticus* pada budidaya udang, sehingga dapat mengurangi ketergantungan terhadap antibiotik sintetis dan mendukung keberlanjutan perikanan.

KATA KUNCI: agen antibakteri; ekstrak tanaman; resistensi; *Shorea beccariana*; *Vibrio parahaemolyticus*

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Peningkatan aktivitas dan ekspresi protein total enzim selulase rekombinan serta potensi aplikasinya pada pakan ikan

Increased activity and total protein expression of recombinant cellulase enzymes and their potential application in fish feed

Jurnal Riset Akuakultur, 20(3), 2025, 257-267

Meskipun enzim selulase rekombinan banyak dikembangkan untuk meningkatkan efisiensi pemecahan serat, informasi mengenai bagaimana modifikasi seperti mutasi dan penambahan tag SKIK (Ser-Lys-Ile-Lys) dapat memengaruhi aktivitas enzim dan produksi protein total masih terbatas. Oleh karena itu, penelitian ini bertujuan mengevaluasi pengaruh mutasi dan penambahan tag SKIK terhadap aktivitas dan protein total enzim selulase rekombinan yang diproduksi oleh *Escherichia coli* BL21 (DE3). Penelitian dilakukan secara eksperimental menggunakan rancangan acak lengkap (RAL) dengan empat perlakuan, yaitu P1 = *wild type* (WT), P2 = WT + SKIK, P3 = mutan, dan P4 = mutan + SKIK, masing-masing dengan empat ulangan. Produksi enzim dilakukan melalui kultur *E. coli* rekombinan yang membawa plasmid pET-22b-CellE dengan induksi laktosa monohidrat, kemudian dianalisis menggunakan uji aktivitas selulase metode 3,5-dinitrosalisilat (DNS) dan pengukuran protein total dengan metode Bradford. Data dianalisis menggunakan ANOVA satu arah dan uji lanjut Duncan pada tingkat signifikansi 5% ($P < 0,05$). Hasil penelitian menunjukkan bahwa perlakuan mutan + SKIK menghasilkan nilai tertinggi baik pada aktivitas enzim ($10,66 \text{ U mL}^{-1}$) maupun protein total ($0,85 \text{ mg mL}^{-1}$). Penambahan SKIK meningkatkan ekspresi dan kelarutan protein, sedangkan mutasi memperbaiki efisiensi katalitik enzim. Kombinasi keduanya memberikan efek sinergis dalam meningkatkan performa enzim selulase rekombinan. Penelitian ini merupakan yang pertama mengombinasikan penambahan tag SKIK dengan mutagenesis untuk meningkatkan ekspresi dan aktivitas katalitik enzim selulase pada *E. coli*. Temuan ini tidak hanya relevan untuk peningkatan produksi enzim pada industri bioteknologi, tetapi juga berpotensi diaplikasikan dalam formulasi pakan ikan.

KATA KUNCI: aktivitas enzim; mutasi; protein total; selulase rekombinan; SKIK

*Although recombinant cellulase enzymes have been widely developed to enhance fiber-degradation efficiency, information regarding how modifications such as mutagenesis and the addition of the SKIK (Ser-Lys-Ile-Lys) tag influence enzymatic activity and total protein production remains limited. Therefore, this study aimed to evaluate the effects of mutagenesis and SKIK tagging on the activity and total protein yield of recombinant cellulase expressed in *Escherichia coli* BL21 (DE3). The research was conducted experimentally using a completely randomized design (CRD) with four treatments: P1 = wild type (WT), P2 = WT + SKIK, P3 = mutant, and P4 = mutant + SKIK, each consisting of four replications. Enzyme production was carried out using recombinant *E. coli* harboring the pET-22b-CellE plasmid induced with lactose monohydrate, and the resulting enzyme was analyzed for cellulase activity using the 3,5-dinitrosalicylic acid (DNS) method and total protein concentration using the Bradford assay. Data were analyzed using one-way ANOVA followed by Duncan's post-hoc test at a 5% significance level ($P < 0.05$). The results showed that the mutant + SKIK treatment produced the highest values for both enzymatic activity (10.66 U mL^{-1}) and total protein (0.85 mg mL^{-1}). The addition of the SKIK tag enhanced protein expression and solubility, whereas mutagenesis improved catalytic efficiency. The combination of both modifications produced a synergistic effect, resulting in superior performance of the recombinant cellulase enzyme. This study is the first to combine SKIK tagging with mutagenesis to enhance the expression and catalytic activity of cellulase in *E. coli*. These findings are not only relevant for improving enzyme production in biotechnology industries but also hold potential applications in fish feed formulation.*

KEYWORDS: enzyme activity; mutation; recombinant cellulase; SKIK; total protein

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Disease dynamics and cross-transmission risks in cultured and wild Baramundi (*Lates calcarifer*) in Inner Ambon Bay, Indonesia

*Dinamika dan resiko transmisi silang penyakit pada ikan kakap putih (*Lates calcarifer*) budidaya dan liar di Teluk Ambon Dalam, Indonesia*

Jurnal Riset Akuakultur, 20(3), 2025, 269-286

This study aimed to evaluate the potential infection of bacteria *Vibrio* spp. and parasites in farmed barramundi (*Lates calcarifer*) and wild fish inhabiting Inner Ambon Bay. The research was conducted over a five-month period (August–December 2024) using a purposive sampling, to monthly collect and analyse two barramundi populations. Bacteria were isolated from liver and kidney tissues of the collected fish using Sea Water Complate (SWC) agar and Tiosufat Citrate Bile-salt Sucrose (TCBS) agar and identified with the Analytical Profile Indeks (API) 20 Non-Enteric (NE) kit. Parasitic identification was performed microscopically on gills, skin, and intestinal samples. The results revealed that *Vibrio* spp. were detected at relatively high abundance, dominated by *V. harveyi*, *V. alginolyticus*, and *V. vulnificus*. Identified parasites included *Trichodina* sp., *Cryptocaryon irritans*, *Benedenia* sp., and nematodes. Parasite infection prevalence in cultured barramundi ranged from 40% to 70%, whereas in wild fish it reached 60%. These findings strongly indicate the potential for cross-transmission of diseases between cultured and wild fish populations in Inner Ambon Bay.

KEYWORDS: Inner Ambon Bay; *Lates calcarifer*; parasite; *Vibrio* spp.

Penelitian ini bertujuan mengevaluasi potensi infeksi bakteri *Vibrio* spp. dan parasit pada ikan kakap putih (*Lates calcarifer*) budidaya dan ikan liar di perairan Teluk Ambon Dalam. Penelitian dilaksanakan selama lima bulan (Agustus–Desember 2024) dengan metode purposive sampling, masing-masing lima ekor ikan kakap putih budidaya dan lima ekor ikan liar setiap bulan. Isolasi bakteri dilakukan dari organ hati dan ginjal menggunakan media SWC agar dan TCBS agar, sedangkan identifikasi bakteri menggunakan kit API 20 NE. Identifikasi parasit dilakukan melalui pemeriksaan mikroskopis pada organ target, yaitu insang, kulit, dan usus. Hasil penelitian menunjukkan bahwa *Vibrio* spp. ditemukan dengan kelimpahan relatif tinggi, didominasi oleh *V. harveyi*, *V. alginolyticus*, dan *V. vulnificus*. Jenis Parasit yang teridentifikasi meliputi *Trichodina* sp., *Cryptocaryon irritans*, *Benedenia* sp., dan nematoda. Prevalensi infeksi parasit pada ikan budidaya berkisar 40–70%, sedangkan pada ikan liar mencapai 60%. Hasil penelitian ini mengindikasikan adanya potensi penularan silang penyakit antara ikan budidaya dan ikan liar di Teluk Ambon Dalam.

KATA KUNCI: Teluk Ambon Dalam; kakap putih; parasit; *Vibrio* spp.

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Pengayaan pakan dengan kombinasi minyak limbah ikan patin dan minyak cumi-cumi terhadap pertumbuhan dan kelulushidupan larva ikan baung (*Hemibagrus nemurus*)

Feed enrichment with a combination of Pangasius waste oil and squid oil on the growth and survival of Asian redbtail catfish larvae (Hemibagrus nemurus)

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Pertumbuhan dan tingkat kelangsungan hidup ikan baung (*Hemibagrus nemurus*) pada stadia larva tidak menentu yang disebabkan oleh rendahnya kualitas pakan yang tersedia. Salah satu strategi untuk meningkatkan kualitas pakan larva adalah melalui pengayaan pakan fermentasi dengan minyak yang berasal dari ikan. Penelitian ini bertujuan untuk menentukan kombinasi terbaik antara minyak limbah ikan patin dan minyak cumi-cumi dalam pakan fermentasi guna meningkatkan performa pertumbuhan dan kelangsungan hidup larva ikan baung. Rancangan percobaan yang digunakan adalah Rancangan Acak Lengkap (RAL) dengan enam perlakuan dan tiga ulangan, yaitu: P1 (*Tubifex* sp.), P2 (pakan fermentasi + 12% minyak limbah ikan patin), P3 (pakan fermentasi + 12% minyak cumi-cumi), P4 (Pakan fermentasi + minyak limbah ikan patin + minyak cumi-cumi 1:1 (10 g minyak limbah ikan patin + 10 g minyak cumi-cumi) dosis 12%), P5 (Pakan fermentasi + minyak limbah ikan patin + minyak cumi-cumi 1:2 (10 g minyak limbah ikan patin + 20 g minyak cumi-cumi) dosis 12%), dan P6 (Pakan fermentasi + minyak limbah ikan patin + minyak cumi-cumi 1:3 (10 g minyak limbah ikan patin + 30 g minyak cumi-cumi) dosis 12%). Larva dipelihara selama 40 hari dengan kepadatan 5 ekor L⁻¹. Hasil penelitian menunjukkan bahwa pengayaan pakan berpengaruh nyata ($p < 0,05$) terhadap bobot mutlak, panjang mutlak, laju pertumbuhan spesifik (LPS), dan tingkat kelangsungan hidup. Performa terbaik diperoleh pada kombinasi 1:3, yang menghasilkan bobot mutlak sebesar 0,80 g, panjang mutlak 3,45 cm, LPS sebesar 14,07% hari⁻¹, dan tingkat kelangsungan hidup sebesar 75,11%. Larva menunjukkan perilaku makan yang aktif dengan sisa pakan yang minimal.

KATA KUNCI: larva ikan baung; minyak limbah ikan patin; pertumbuhan; kelulushidupan

The growth and survival rate of the Asian redbtail catfish (Hemibagrus nemurus) during larval stage are inconsistent due to low quality of available diets. One of the options to improve the larval diets is through enriching fermented fish with fish-derived oils. This study aimed to determine the optimal combination of pangasius waste oil and squid oil in fermented feed to improve larval growth performance and survival. A Completely Randomized Design (CRD) with six treatments and three replications was applied: P1 (Tubifex sp.), P2 (fermented feed + 12% pangasius waste oil), P3 (fermented feed + 12% squid oil), P4 (Fermented feed + pangasius waste oil + squid oil at a ratio of 1:1 [10 g pangasius waste oil + 10 g squid oil] with a dosage of 12%), P5 (Fermented feed + pangasius waste oil + squid oil at a ratio of 1:2 [10 g pangasius waste oil + 20 g squid oil] with a dosage of 12%), and P6 (Fermented feed + pangasius waste oil + squid oil at a ratio of 1:3 [10 g pangasius waste oil + 30 g squid oil] with a dosage of 12%). Larvae were reared for 40 days at a stocking density of 5 individuals L⁻¹. Results demonstrated that feed enrichment significantly affected ($p < 0.05$) absolute weight, absolute length, specific growth rate (SGR), and survival rate. The best performance was obtained with the 1:3 combination, yielding an absolute weight of 0.80 g, an absolute length of 3.45 cm, an SGR of 14.07% day⁻¹, and a survival rate of 75.11%. Larvae exhibited active feeding behavior with minimal feed residues.

KEYWORDS: Asian redbtail catfish larvae; *Pangasius* waste oil; growth; survival rate

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Growth and survival rate of domesticated *Jielabu* fish (*Betta dennisyongi* Tan, 2013) reared with different stocking densities

Pertumbuhan dan kelangsungan hidup ikan Jielabu (Betta dennisyongi Tan, 2013) yang dipelihara dengan padat tebar yang berbeda

Jurnal Riset Akuakultur, 20(3), 2025, 307-317

Betta dennisyongi, locally known as *Jielabu* fish, is an endemic ornamental species originating from southwest Nanggroe Aceh Darussalam, Indonesia. The fish currently faces increasing exploitation and habitat degradation which raise conservation concerns and emphasize the need for domestication efforts. This study aimed to determine an appropriate stocking density for the early culture of *B. dennisyongi*. The research was conducted from October to December 2023 using a completely randomized design with four stocking densities (1, 2, 3, and 4 fish L⁻¹) with three replications. Juvenile fish collected from the wild were acclimated and reared for 60 days in 10-L aquaria. Biological parameters measured included survival, specific growth rate, length gain, weight gain, feed conversion ratio, and feed efficiency, while water quality was monitored periodically. Stocking density significantly affected survival rate and growth ($p < 0.05$) of *B. dennisyongi*, with the lowest density (1 fish L⁻¹) producing the most favorable performance, while densities of 3–4 fish L⁻¹ resulted in reduced outcomes. Feed conversion ratio and feed efficiency did not differ significantly among treatments ($p > 0.05$). All measured water quality parameters remained within acceptable ranges for *Betta* fish culture. Overall, the study indicates that lower stocking densities support better biological responses, and that 1 fish L⁻¹ is the most suitable for cultivation, while 2 fish L⁻¹ may serve as an acceptable alternative for practical application. These findings provide a foundation for developing effective domestication protocols and support conservation-oriented aquaculture of this vulnerable endemic species.

KEYWORDS: economic value; endemic ornamental fish; *jielabu* fish; natural catch; stocking density

Betta dennisyongi, yang dikenal secara lokal sebagai ikan Jielabu, merupakan spesies ikan hias endemik dari wilayah barat daya Nanggroe Aceh Darussalam, Indonesia. Peningkatan pemanfaatan dan degradasi habitatnya telah menimbulkan kekhawatiran dalam kegiatan konservasi dan menekankan perlunya upaya domestikasi. Penelitian ini bertujuan untuk menentukan padat tebar yang sesuai untuk pemeliharaan awal *B. dennisyongi*. Penelitian dilakukan pada bulan Oktober hingga Desember 2023 menggunakan rancangan acak lengkap dengan empat padat tebar (1, 2, 3, dan 4 ekor L⁻¹) masing-masing dengan tiga ulangan. Benih ikan yang dikumpulkan dari alam diaklimatisasi dan dipelihara selama 60 hari dalam akuarium berkapasitas 10 L. Parameter biologis yang diukur meliputi kelangsungan hidup, laju pertumbuhan spesifik, pertambahan panjang, pertambahan bobot, rasio konversi pakan, dan efisiensi pakan, sedangkan kualitas air dipantau secara berkala. Padat tebar berpengaruh nyata terhadap kelangsungan hidup dan pertumbuhan ($p < 0.05$) *B. dennisyongi*, di mana padat tebar terendah (1 ekor L⁻¹) memberikan performa terbaik, sedangkan padat tebar 3–4 ekor L⁻¹ menghasilkan performa yang lebih rendah. Rasio konversi pakan dan efisiensi pakan tidak berbeda nyata antarperlakuan ($p > 0.05$). Seluruh parameter kualitas air berada dalam kisaran yang sesuai untuk budidaya *Betta* fish. Secara keseluruhan, penelitian ini menunjukkan bahwa padat tebar rendah mendukung respons biologis yang lebih baik, dan 1 ekor L⁻¹ merupakan padat tebar yang paling sesuai, sementara 2 ekor L⁻¹ masih dapat diaplikasikan. Temuan ini menjadi dasar bagi pengembangan protokol domestikasi yang efektif dan mendukung budidaya yang berorientasi pada konservasi bagi spesies endemik rentan ini.

KATA KUNCI: ikan hias endemik; ikan jielabu; nilai ekonomis; padat tebar; tangkapan alam

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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.
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.

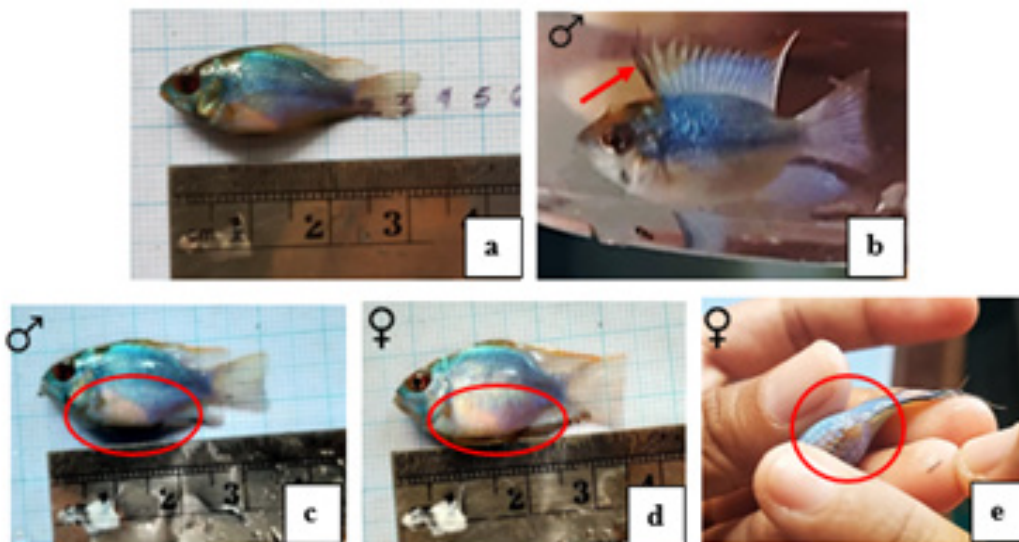


Figure 1. Visual observations of gonad matured ramirezi broodstock: (a) research start (b) ramirezi male at the end of the research with a black elongated front dorsal fin (c) ramirezi male with a bluer body and belly (d) ramirezi female with a pink belly (e) prominent and yellow urogenital.

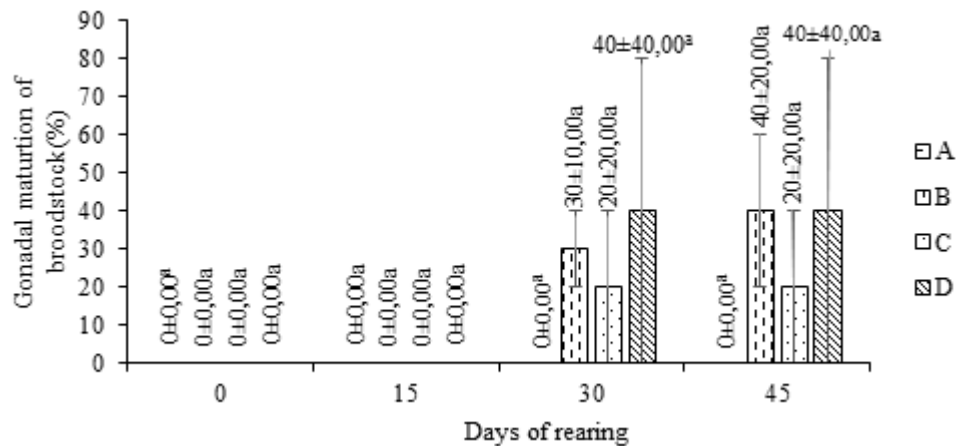


Figure 2. Accumulation percentage of gonadal mature ramirezi broodstock after treatments (combined ratio of artificial feed to bloodworms (*Chironomus* sp.): (A) 3:0, (B) 0:3, (C) 2:1, and (D) 1:2)) on day 0 to day 45

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