



Rozirwan ROZIRWAN <rozirwan@unsri.ac.id>

[TJNPR] Submission Acknowledgement

1 pesan

editor@tjnpr.org <editor@tjnpr.org>

23 Juli 2024 pukul 14.52

Balas Ke: Prof Abiodun Falodun <editor.tjnpr@gmail.com>

Kepada: rozirwan rozirwan <rozirwan@unsri.ac.id>

rozirwan rozirwan:

Thank you for submitting the manuscript, "Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers" to Tropical Journal of Natural Product Research (TJNPR). With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Submission URL: <https://tjnpr.org/index.php/home/authorDashboard/submission/4346>

Username: rozirwantjnpr

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Prof Abiodun Falodun

[Tropical Journal of Natural Product Research \(TJNPR\)](#)

Email: editor.tjnpr@gmail.com | Phone: +2348073184488



Roziwan ROZIRWAN <roziwan@unsri.ac.id>

TJNPR Manuscript Submission Request

4 pesan

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

25 Juli 2024 pukul 21.51

Kepada: Roziwan unsri <roziwan@unsri.ac.id>

Thank you for submitting your original manuscript to the Tropical Journal of Natural Product Research (TJNPR) www.tjnpr.org TJNPR is indexed in SCOPUS/SCIMAGO **Q3** Journal Ranking (<https://www.scopus.com/sourceid/21100933230>).

Please, provide the following information:

1. suggest four (4) competent reviewers foreign/international. Their names, university-based email addresses and affiliations should be submitted.
2. The email addresses of all the authors including their roles/contributions in the manuscript should also be submitted.

The peer-review process will commence immediately, as the manuscript will be passed to an editor for initial assessment as soon as possible. If there are any problems with your submission, we will contact you. Also, note that manuscripts submitted and undergoing peer review will not be accepted for withdrawal or retraction.

Title: Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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Roziwan unsri <roziwan@unsri.ac.id>
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26 Juli 2024 pukul 04.37

Thank you for the information.
 Warm regards
 [Kutipan teks disembunyikan]

Roziwan unsri <roziwan@unsri.ac.id> 26 Juli 2024 pukul 04.37
 Kepada: Nadila Nur Khotimah <nadilakhotimah1142@gmail.com>, Redho Yoga Nugroho <redhoyng.29@gmail.com>,
 Redho YN <redhoyoga29@gmail.com>

[Kutipan teks disembunyikan]

Roziwan unsri <roziwan@unsri.ac.id>
 Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

26 Juli 2024 pukul 06.17

Dear Editor
 Thank you for your advice

Here we send some information you need

The Four Potential Intenational Reviewers

1. Prof. Che Abd Rahim Mohamed
 Faculty of Science and Technology,Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia
 Email carmohd@ukm.edu.my
 His skills and expertise in chemical exploration in marine biota and vegetation is very helpful for reviewing our articles

2. Mohamad Fawzi Mahomoodally
 Department of Health Sciences, Faculty of Science, University of Mauritius, 230 Réduit, Mauritius
 Email f.mahomoodally@uom.ac.mu
 His skills and expertise in Phytochemicals, Natural Products, Medicinal Plants is very helpful for reviewing our articles

3. Muthu Thiruvengadam, Ph.D
 Department of Applied Bioscience, Konkuk University, Seoul
 Email muthu@konkuk.ac.kr
 His skills and expertise in Natural Product, Medicinal and Pharmaceutical, Drug Discovery is very helpful for reviewing our articles

4. Benjamin Boucherle, Ph.D
 Université Grenoble Alpes · Departement de Pharmacochimie Moléculaire
 Email Benjamin.boucherle@univ-grenoble-alpes.fr
 His skills and expertise in Natural Product, Medicinal and Pharmaceutical, Drug Discovery is very helpful for reviewing our articles

Email addresses and roles in the study of Co-Author

Roziwan roziwan@unsri.ac.id contributed to the design of the research and supervised the findings of this work
Rama Dhanti dhantirozali@gmail.com contributed to the analysis of the results and to the writing of the manuscript
Nadila Nur Khotimah nadilakhotimah1142@gmail.com contributed to the analysis of the results and to the writing of the manuscript
Isnaini isnainimawardi22@gmail.com contributed to the design of the research and supervised the findings of this work

Fauziyah siti_fauziyah@yahoo.com contributed to the design of the research and supervised the findings of this work
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Muhammad Hendri muhammad.hendri@unsri.ac.id contributed to the design of the research and supervised the findings of this work

Rezi Apri rezi_apri@unsri.ac.id contributed to the design of the research and supervised the findings of this work

Gusti Diansyah gustidiansyah@unsri.ac.id contributed to the design of the research and supervised the findings of this work

Redho Yoga Nugroho redhoyn.29@gmail.com contributed to the analysis of the results and to the writing of the manuscript

Hefni Effendi hefni.effendi@apps.ipb.ac.id contributed to the design of the research and supervised the findings of this work

[Kutipan teks disembunyikan]

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Head of Marine Bioecology Laboratory

Department of Marine Science

Faculty of Mathematics and Natural Sciences

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Roziwan ROZIRWAN <roziwan@unsri.ac.id>

Confirm co-authorship of submission to Tropical Journal of Natural Product Research

1 pesan

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

31 Juli 2024 pukul 18.40

Kepada: Roziwan unsri <roziwan@unsri.ac.id>

Cc: dhantirozali@gmail.com, nadilakhotimah1142@gmail.com, isnainimaward22@gmail.com, siti_fauziyah@yahoo.com, wike_ayu_ep@unsri.ac.id, muhammad.hendri@unsri.ac.id, rezi_apri@unsri.ac.id, gustidiansyah@unsri.ac.id, redhoyn.29@gmail.com, hefni.effendi@apps.ipb.ac.id

The manuscript submitted to the Tropical Journal of Natural Product Research <https://www.scopus.com/sourceid/21100933230> SCOPUS Q3 Ranking by the corresponding author is undergoing the peer-review process.

Title: **Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers**

Journal: Tropical Journal of Natural Product Research www.tjnpr.org SCOPUS/SCIMAGO Q3

Corresponding Author: Roziwan

Co-authors: Rama Dhanti, Nadila Nur Khotimah, Isnaini, Fauziyah, Wike Ayu Eka Putri, Muhammad Hendri, Rezi Apri, Gusti Diansyah, Redho Yoga Nugroho, Hefni Effendi

Manuscript No: TJNPR MH283ARN

If you have any objections, please contact the editorial office as soon as possible. If we do not hear from you, we will assume you agree with your co-authorship.

If you did not co-author this submission, please contact the corresponding author directly

The Editorial decision of the manuscript will be communicated soon

Thank you very much.

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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3 September 2024 pukul 09.03

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Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

3 September 2024 pukul 14.33

Kepada: Roziwan ROZIRWAN <roziwan@unsri.ac.id>

Please submit the ethical approval

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Roziwan ROZIRWAN <roziwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

4 September 2024 pukul 07.32

Dear Editor,

I would like to inform you that the ethical approval document has been uploaded in the Pre-Review Discussions section. Please let me know if there are any additional steps or documentation required.

Thank you
Best regards

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Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>
Kepada: Roziwan ROZIRWAN <roziwan@unsri.ac.id>

4 September 2024 pukul 21.00

[submit by email attachment](#)

[Best regards](#)

[Abiodun](#)

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Rozirwan ROZIRWAN <rozirwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

5 September 2024 pukul 04.42

Dear Editor,

As per your request, I have attached the ethical approval. Should you require any further information, please do not hesitate to reach out.

Thank you
Best regards

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5 September 2024 pukul 14.24

the ethical approval should be on letterhead. The Email and telephone number of the Director should be included

Best regards

Abiodun

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5 September 2024 pukul 16.05

Dear Editor,

We have made the necessary revisions, including placing the document on the letterhead, email address, and telephone number of the Director as requested.

Thank you
Best regards

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5 September 2024 pukul 23.39

ok

Best regards

Abiodun

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23 Oktober 2024 pukul 08.27

Dear Editor,

After a few months ago we submitted our article, we would like to inquire about the progress of my submitted manuscript entitled "Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers".
Manuscript No: TJNPR MH283ARN

Thank you
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Kepada: Roziwan ROZIRWAN <roziwan@unsri.ac.id>

27 Oktober 2024 pukul 13.43

no update from reviewers yet

Best regards

Abiodun

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18 Desember 2024 pukul 10.16

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Ogan Ilir, Sumatera Selatan, Indonesia, Pos Code: 30862
Email: roziwan@unsri.ac.id, roziwan@gmail.com

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>
Kepada: Roziwan ROZIRWAN <roziwan@unsri.ac.id>

18 Desember 2024 pukul 22.41

We will update you soon.

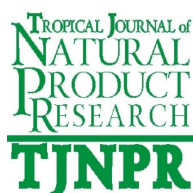
Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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Roziwan ROZIRWAN <roziwan@unsri.ac.id>

Trop J Nat Prod Res Editorial Decision

5 pesan

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

9 Februari 2025 pukul 23.20

Kepada: Roziwan unsri <roziwan@unsri.ac.id>

Dear Prof Roziwan,

The manuscript submitted to the Tropical Journal of Natural Product Research www.tjnpr.org Q3

<https://www.scopus.com/sourceid/21100933230> has been carefully reviewed by competent experts.

Find attached the details of the decision.

Please send your response urgently to the Editor-in-Chief, to enable us to process your manuscript for the next issue **Vol 9 issue 2, 2024**.

Kindly acknowledge the receipt of the mail.

Title: Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers

Authors: Roziwan, Rama Dhanti, Nadila Nur Khotimah, Isnaini, Fauziyah, Wike Ayu Eka Putri, Muhammad Hendri, Rezi Apri, Gusti Diansyah, Redho Yoga Nugroho, Hefni Effendi*

TJNPR Editorial Decision: Accepts with moderate corrections

Congratulations.



<https://www.scimagojr.com/journalsearch.php?q=21100933230&tip=sid>

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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Provisional acceptance 283.pdf

313K

Rozirowan ROZIRWAN <rozirowan@unsri.ac.id>

Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

11 Februari 2025 pukul 21.06

Dear Editor,

We are experiencing difficulties logging into the TJNPR website. Each time we attempt to log in, we receive an "Invalid username or password" message. We have also tried using the "Forgot Password" option and requested a reset email for our account (rozirwan@unsri.ac.id), but we have not received any email instructions so far.

Could you please assist us in resolving this issue? Is there any additional step we need to take to regain access to our account?

We appreciate your help and look forward to your response.

Best regards,

[Kutipan teks disembunyikan]

--

Prof. Dr. Rozirwan

Head of Marine Bioecology Laboratory

Department of Marine Science

Faculty of Mathematics and Natural Sciences

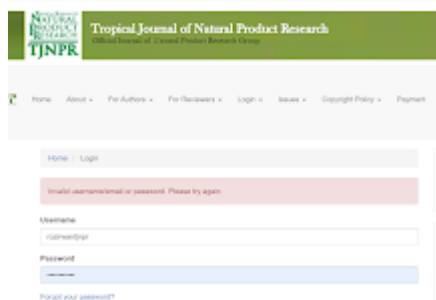
Sriwijaya University

Jalan Raya Palembang-Prabumulih KM 32, Indralaya

Ogan Ilir, Sumatera Selatan, Indonesia, Pos Code: 30862

Email: rozirwan@unsri.ac.id, rozirwan@gmail.com

Editor-in-Chief: Prof. Abiodun Falodun (Profile)



Invalid Username.png
207K

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>
Kepada: Rozirwan ROZIRWAN <rozirwan@unsri.ac.id>

11 Februari 2025 pukul 21.17

Please make the APC payment, then the review comments will be sent to you as soon as possible
For the website use 123456 as password

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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[Kutipan teks disembunyikan]

Roziwan ROZIRWAN <roziwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

12 Februari 2025 pukul 11.43

Dear Editor,

We would like to confirm that we have completed the payment for the publication fee of our manuscript titled "*Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers*". Please find the payment receipt attached for your reference.

However, we are currently experiencing issues logging into the system. We would appreciate your assistance in resolving this matter so we can proceed with the next steps.

Kindly let us know if there are any further requirements from our side. We look forward to your response.

Thank you for your attention and support.

Best regards,

[Kutipan teks disembunyikan]

2 lampiran



Form Remittance_TJNPR MH283ARN.pdf
224K



APC Payment_TJNPR MH283ARN.pdf
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Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>
Kepada: Roziwan ROZIRWAN <roziwan@unsri.ac.id>

12 Februari 2025 pukul 14.42

Thank you for the APC payment. The review comments will be sent as soon as possible

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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Editorial and Review comments

6 pesan

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

14 Februari 2025 pukul 23.57

Kepada: Roziwan unsri <roziwan@unsri.ac.id>

Please see the editorial comments (below) and attached copies of the reviewer comments for manuscript title " Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers."

Editorial comments to authors

Title: Names (First and Last name in full, middle name as initials) and affiliations of authors should be written correctly. Correspondence authors' contact address (email and telephone number) should also be stated.

Abstract: format to accommodate to the required word (250) limit. Format to a single paragraph and avoid subheadings. Begin with a brief background, the aim of study should be clearly stated, methodology, results and conclusion.

All botanical and zoological names should be **italicized including those in reference section**

For non-integers, use periods/decimal point NOT commas.

Write all page number in full. E.g 12345 – 12359 and not 12345 – 59

Remove italics and abbreviate journal title in reference section

In-text references should be in superscript numerals without square brackets, and placed after commas or full-stop.

References: Cite relevant and related references from the published articles of TJNPR www.tjnpr.org

Adhere strictly to the Journal's style for listing references. Abbreviate all journal names, and replace 'et al' with names of all contributing authors;

Falodun A, Siraj R, Choudhary MI. GC-MS Insecticidal Leaf essential oil of *P. staudtii* Hutch and Dalz (Icacinaceae). Trop J. Pharm Res. 2009; 82:139-143.

Okolie NP, Falodun A, Oluseyi D. Evaluation of the antioxidant activity of root extract of pepper fruit (*Dennetia tripetala*), and its potential for the inhibition of Lipid peroxidation. Afr J. Trad Compl and Altern Med. 2014; 11(3):221-227. Doi: 10.4314/ajtcam. v11i3.31

Conflict of interest session should be included, and if there is no conflict of interest, this should be stated clearly as follows; **The authors declare no conflict of interest.**

A declaration of the liability of the authors for claims relating to the content of this article should also be included when submitting the revised manuscript. This should be stated as follows;

Authors' Declaration

The authors hereby declare that the work presented in this article are original and that any liability for claims relating to the content of this article will be borne by them.

All comments/corrections made by reviewers should be completely addressed, point by point, and make appropriate changes in the manuscript, or provide a suitable rebuttal to any specific request for change that has not been made.

All corrections/changes made in the manuscript should be **highlighted in yellow colour** when submitting the manuscript in the revised form.

Please keep the revised manuscript code format as “TJNPR-(Year)-(Code). Do not Rename the document.

All corrections/changes made in the manuscript should be **highlighted in yellow colour** when submitting the manuscript in the revised form.

The authors should carefully revise and correct the manuscript taking into consideration the comments of all the reviewers. 50% of the references cited should be between **2020-2025**. The revised and corrected manuscript should be subjected to plagiarism checker (17% allowed in TJNPR) and English language editing. Evidence of the checks should be attached when submitting the revised/corrected manuscript.

During submission of the revised manuscript include another file labelled “**Responses to reviewers’ comments**” (a matrix) clearly showing your responses to each of the issues raised by the reviewers; mention the section, page and paragraph/lines where and how the changes/corrections have been made.

Strictly adhere to the author guidelines. Make sure that all the facts and information provided in the manuscript are correct. Check grammar, spelling, spacing, other information and facts including scientific names, formulae, symbols, equations, etc.

Ensure that all the references are correctly cited in the text and list. Verify all the references from their original sources. Confirm correctness of the citation info such as authors’ names (surnames, initials, spelling, arrangements, etc), year, title, journal, volume, pages, punctuation, etc. The numbers and units must be presented according to the journal style. Use clearly distinguishable patterns for the illustrations/figures (e.g., graphs and charts) such that they should be legible even for black and white printing or when reduced in size.

Proofread the whole document after effecting all the corrections. The revised version should be approved by all the co-authors before submitting it.

Important Points for authors

A. Authors strongly advised to read and comply with items 1-11.

B. Authors are also required to submit the files (1-4) when submitting the revised manuscript.

C.

1. The revised and edited manuscript
2. The list of responses to reviewers' comments (All the issues raised by the reviewers must be addressed)
3. Evidence of plagiarism check (**17% allowed**)
4. Evidence of grammar check by a native English speaker
5. All references cited **MUST** in **English Language**
6. All references cited should tally with the number of references listed
7. All journal titles must be abbreviated in line with the international citation standard eg Tropical Journal of Natural Product Research is abbreviated as Trop J Nat Prod Res
8. **Tables and figures should be at the last page after the list of references**
9. **The tables must comply with the journal style.**
10. **Authors advised to download some articles from the TJNPR website to serve as a guide.**
11. ***et al* is not allowed in the references. The full authors list should be mentioned.**

D. For references: Use the references as guide

Falodun A, Siraj R, Choudhary MI. GC-MS Insecticidal Leaf essential oil of *P. staudtii* Hutch and Dalz (Icacinaeae). Trop J. Pharm Res. 2009; 82:139-143.

Okolie NP, Falodun A, Oluseyi D. Evaluation of the antioxidant activity of root extract of pepper fruit (*Dennetia tripetala*), and its potential for the inhibition of Lipid peroxidation. Afr J. Trad Compl and Altern Med. 2014; 11(3):221-227. Doi: 10.4314/ajtcam. v11i3.31

Best regards

Abiodun

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3-Editorial comment TJNPR-2024-M393a.docx
17K



2-TJNPR-2024-M393 Reviewed 1.docx
2084K

Roziwan ROZIRWAN <roziwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

7 Maret 2025 pukul 11.29

Dear Editor

We have completed the revisions for my manuscript titled " **Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers** " (**Manuscript ID: 2-**

TJNPR-2024-M393), as per the reviewers' comments. However, I am currently unable to access my account on the submission system to upload the revised version.

Could you please assist me in resolving this issue? Alternatively, if possible, I would be happy to send the revised manuscript and response to reviewers via email for your review. Kindly let me know the best course of action.

Best regards

[Kutipan teks disembunyikan]

--

Prof. Dr. Rozirwan

Head of Marine Bioecology Laboratory

Department of Marine Science

Faculty of Mathematics and Natural Sciences

Sriwijaya University

Jalan Raya Palembang-Prabumulih KM 32, Indralaya

Ogan Ilir, Sumatera Selatan, Indonesia, Pos Code: 30862

Email: rozirwan@unsri.ac.id, rozirwan@gmail.com

Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>
Kepada: Rozirwan ROZIRWAN <rozirwan@unsri.ac.id>

7 Maret 2025 pukul 19.34

Please submit the revised manuscript to this email address

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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[Kutipan teks disembunyikan]

Rozirwan ROZIRWAN <rozirwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

10 Maret 2025 pukul 13.28

Dear Editor,

We have completed the revisions to our manuscript entitled " Antioxidant activity and phytochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers " (Manuscript ID: 2-TJNPR-2024-M393) for consideration. We have carefully addressed all the comments and suggestions provided by the reviewers and have made the necessary changes to improve the quality of the manuscript.

The revised version of the manuscript, along with a detailed response to the reviewers' comments, is attached for your kind consideration. We believe that the changes made have strengthened the paper, and we hope that it will now meet the expectations of the reviewers and editors.

Please let me know if there are any further revisions required or if additional information is needed. We look forward to hearing from you soon regarding the next steps.

Thank you

Best regards,

[Kutipan teks disembunyikan]

3 lampiran

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Kepada: Rozirwan ROZIRWAN <rozirwan@unsri.ac.id>

10 Maret 2025 pukul 23.00

The revision is unsatisfactory. Please provide the chromatogram, and the English edited version. Please seek the assistance of a native English speaker/ editor for the English editing and proper formatting. Dr Imieje (vincent.imieje@uniben.edu; vincent.imieje@gmail.com). Send the revised copy and the certificate of English editing when submitting the revised version.

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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[Kutipan teks disembunyikan]

Roziwan ROZIRWAN <roziwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

11 Maret 2025 pukul 13.33

Thank you, I will do that.

[Kutipan teks disembunyikan]

Table of Responses

a. Reviewer's specific comments per manuscript section

Comments		Answers
Title	The title is mostly appropriate	-
Abstract	The abstract word count is < 250. The authors should correct all grammatical, spellings and punctuation errors. • The abstract should be revised as recommended	We have revised the abstract to ensure it meets the recommended word count of <250 words. Additionally, all grammatical, spelling, and punctuation errors have been corrected as suggested.
Keywords	Keywords are okay	-
Introduction	The aim and objectives of the research should be made obvious. The authors should include a statement of research novelty. Authors should briefly discuss the relevance of the research methods to the research. All grammatical, spellings and punctuation errors should be corrected. The literature review should mostly be contextual. Use recent citations. Abbreviated words should be mentioned in full prior to abbreviations. The first citation should be numbered as 1, the second 2, third 3 etc. – in sequential order of appearance • The introduction should be improved as recommended	We have carefully revised the introduction to address all the points raised. The aim and objectives of the study have been explicitly stated to ensure clarity, and a statement highlighting the research novelty has been included. All grammatical, spelling, and punctuation errors have been corrected, and the literature review has been refined to ensure contextual relevance with the study. We have ensured that all abbreviations are introduced with their full terms before being abbreviated. Furthermore, the citation numbering has been adjusted to follow a sequential order of appearance.
Methodology	All chemicals and reagents used should be mentioned alongside the manufacturer, % purity, conc., grade and specificities. All equipment and instrument used should be mentioned	We have revised the manuscript accordingly. However, in this study, statistical analysis was not conducted as the focus is

	alongside their model, manufacturer and country. Authors should specify instruments/equipment used for each experiment. Include methods for the statistical analysis. Mention the software used in the statistical analysis alongside the manufacturer, version and release year. Include the number of replicate measurements. All methods used should be validated with relevant citations. All grammatical, spellings and punctuation errors should be corrected. • Methods used are mostly appropriate for the research	solely on examining the antioxidant content in fiddler crabs from both regions.
Results	All results should be presented based on the journal guideline. Images should be of a very high quality/resolution (300 dpi). Authors should forward all supplementary data (input and output files) associated with the research to the journal management for validations and authentications. Use footnotes were necessary to define terms. For the IC₅₀ – use graphs used in the determination of the IC₅₀ instead of tables (Table 5). If table 1 is an excerpt from another manuscript – cite the source used. Crosscheck the methodologies to ensure that results obtained tally with methods used • The results obtained are mostly appropriate for the methods used.	We have carefully revised the manuscript to align with the journal guidelines. Table 1 is a quote from another manuscript that has been included in the sentence in the data analysis sub-chapter with citation number 64. The data in table 5 has been changed to be presented in graphic form (figure 4).
Discussion	The discussions should be mostly statistically comparative. Authors should discuss mainly the significant findings in details. Authors should use recent citations in discussing their findings. All grammatical, spellings and punctuation errors should be corrected. Use recent citations in discussing the manuscript findings • The discussion should be improved	We have revised the discussion section to focus more on the key findings and their detailed interpretation. Additionally, we have incorporated recent references to strengthen the discussion and ensure its relevance. All grammatical, spelling, and punctuation errors have been corrected

		to improve clarity and readability.
Conclusion	Authors captured the future prospects of the research.	-
References	Authors should ensure that all the references follow the journal guideline. The number of cited references must tally with those at the references sections	We have revised the reference list to comply with the journal guidelines. The number of cited references now matches those in the reference section.
Figures	All figures should be presented based on the journal guideline. All figures should be of a very high quality/resolution. Figures captured were discussed in the manuscript.	-
Tables	All tables should be presented based on the journal guideline. Table captured was discussed in the manuscript.	-

b. Reviewer from Ijoma Ikechukwu

Comments	Answers
The first citation should be numbered as 1, the second 2, third 3 etc. – in order of appearance	We have revised the manuscript by numbering the citations sequentially. Each different citation has been separated with commas to ensure clarity and ease of reference for the reader.
Instruments used alongside their model, manufacturer and country	All environmental parameters were assessed using a multiparameter device (Hanna HI 9829-01042, USA), while salinity was determined with a handheld refractometer (ATC Portable, China).
State vividly what the sample was	The sample is fiddler crab
Citation too old. Cite recent method based on harbone Cite: Ijoma et al. EVIDENCE-BASED PREFERENTIAL <i>IN VITRO</i> ANTISICKLING MECHANISM OF THREE NATIVE NIGERIAN PLANTS USED IN THE MANAGEMENT OF SICKLE CELL DISEASE. Malaysian J Biochem. Mol. Biol. 2022; 3:9-17	We have already cited the article by Ijoma et al. (2022) in our manuscript as per your suggestion.

Requires grammar editing in conclusion	We have revised the grammar in the conclusion as suggested.
Authors should ensure that all the references follow the journal guideline. The number of cited references must tally with those at the references sections	We have revised the reference list to comply with the journal guidelines. The number of cited references now matches those in the reference section.
Use graph used in the determination of the IC50 value	The data in table 5 has been changed to be presented in graphic form (figure 4).

c. Reviewer from EHI Falodun

Comments	Answers
Comply with this reference: Okolie NP, Falodun A, Oluseyi D. Evaluation of the antioxidant activity of root extract of pepper fruit (<i>Dennetia tripetala</i>), and its potential for the inhibition of Lipid peroxidation. Afr J. Trad Compl and Altern Med. 2014; 11(3):221-227. Doi: 10.4314/ajtcam.v11i3.31	We have revised the reference list to comply with the journal guidelines. The number of cited references now matches those in the reference section.
Cite the following references: Free radical scavenging activities of methanol extract and fractions of <i>Picralima nitida</i> (Apoceanacea) O Erharuyi, A Falodun Journal of Applied Sciences and Environmental Management 2012; 16 (3) Antioxidant Evaluation, Acute Toxicity Screening and Heavy Metal Analysis of a Poly Herbal Mixture O Erharuyi, E Itakpe, OF Osemwota, A Falodun ChemSearch Journal 13 (1), 111–119-111–119	We have already cited the following references in our manuscript: Erharuyi and Falodun (2012) discussed the free radical scavenging activities of methanol extract and fractions of <i>Picralima nitida</i> (Apoceanacea) in the <i>Journal of Applied Sciences and Environmental Management</i> (16(3)), while Erharuyi et al. (2013) evaluated the antioxidant activity, acute toxicity, and heavy metal analysis of a poly herbal mixture in the <i>ChemSearch Journal</i> (13(1), 111–119).
Reference in Map	We have added the reference for the map used in our manuscript, which is sourced from Google Earth.
Reference in Figure og Fiddler crab	The figure of the fiddler crab is an original image obtained from our own research. It was captured during the course of our study

Delete table 8. Provide the spectral of the GCMS	We have removed Table 8 as requested. Additionally, the GC-MS spectral data has been included in Figure 3
--	---



Roziwan ROZIRWAN <roziwan@unsri.ac.id>

Apology for Delay in Language Check Document Submission and Request for Alternative Solution

2 pesan

Roziwan ROZIRWAN <roziwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

14 April 2025 pukul 10.47

Dear Editor,

We would like to sincerely apologize for the delay in submitting the English language check certificate as requested. We truly appreciate your previous feedback and have taken steps to comply accordingly.

However, we experienced some difficulties with the payment process to the language editing service. Although we have completed the payment and submitted the necessary documents, including the bank transfer receipt and confirmation from our side that the funds have been received, the language editing provider has stated that they have not yet confirmed the receipt on their end. This situation has unfortunately caused a delay in obtaining the final certificate.

Given this unexpected issue, we would like to ask if there are any alternative solutions that would allow the manuscript to proceed to the next stage of review and publication more promptly. We are eager for our article to be processed soon, especially since we have already completed the APC payment as well.

Once again, we apologize for any inconvenience this may have caused and thank you very much for your understanding and support.

We look forward to your kind advice and possible solutions.

Best regards

--

Prof. Dr. Roziwan
Head of Marine Bioecology Laboratory
Department of Marine Science
Faculty of Mathematics and Natural Sciences
Sriwijaya University
Jalan Raya Palembang-Prabumulih KM 32, Indralaya
Ogan Ilir, Sumatera Selatan, Indonesia, Pos Code: 30862
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Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>
Kepada: Roziwan ROZIRWAN <roziwan@unsri.ac.id>

14 April 2025 pukul 23.05

Dear Prof Roziwan,

Thank you for your information. The English editing is necessary for an excellent manuscript.

Best regards

Abiodun

Professor Abiodun Falodun, PhD; FAAS, FISPON

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Roziwan ROZIRWAN <roziwan@unsri.ac.id>

Request for Permission to Use an Alternative Proofreading Service

2 pesan

Roziwan ROZIRWAN <roziwan@unsri.ac.id>
Kepada: Editor-in-Chief Tjnpr <editor.tjnpr@gmail.com>

6 Mei 2025 pukul 15.02

Dear Editor,

We would like to kindly request your permission to use an alternative English proofreading service. We have followed the recommendation previously provided, including making the required payment, but unfortunately, we have not received any further updates or clarification from them until now.

If permitted, we will immediately look for another certified proofreading service and send the edited version as soon as it is completed, so that the next stage of the review process can proceed without further delay.

We sincerely appreciate your understanding and look forward to your approval.

Best regards,

--

Prof. Dr. Roziwan, S.Pi., M.Sc

Head of Marine Bioecology Laboratory

Department of Marine Science

Faculty of Mathematics and Natural Sciences

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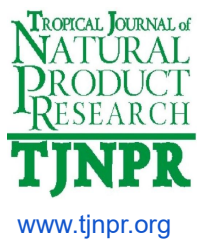
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**Antioxidant Activity and Chemical Profile of Fiddler Crabs as a
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Along Urban Rivers**

Authored by Rozirwan, Rama Dhanti, Nadila N.Khotimah, Isnaini, Fauziyah,
Wike A.E.Putri, Muhammad Hendri, Rezi Apri, Gusti Diansyah, Redho
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Thank you for the opportunity to publish our work in *Tropical Journal of Natural Product Research*. We look forward to the final publication in Volume 9, Issue 9.

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Dear Editor-in-Chief,

With the utmost respect, we would like to kindly request whether it would be possible to reschedule the publication of our manuscript to Issue 7 or the September edition, due to some pending administrative matters on our side that need to be finalized before the publication. We truly appreciate your understanding and support, and we assure you that we remain committed to fulfilling all editorial requirements and revisions as soon as possible.

Please let us know if this adjustment could be considered. We thank you once again for your valuable time and kind attention.

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Original Research Article



Antioxidant Activity and Chemical Profile of Fiddler Crabs as a Form of Self-Defense Against Various Anthropogenic Activities Along Urban Rivers

Rozirwan^{1*}, Rama Dhanti¹, Nadila N.Khotimah^{2,3}, Isnaini¹, Fauziyah¹, Wike A.E.Putri¹, Muhammad Hendri¹, Rezi Apri¹, Gusti Diansyah¹, Redho Y.Nugroho¹, Hefni Effendi⁴¹Department of Marine Science, Faculty of Mathematics and Natural Sciences, Universitas Sriwijaya, Indralaya 30862, South Sumatra, Indonesia²Doctoral Program of Environmental Science, Postgraduate Program, Universitas Sriwijaya, Jl. Padang Selasa Bukit Besar, Palembang 30139, Indonesia.³Department of Aquatic Resources Management, Faculty of Fisheries, Universitas Islam Ogan Komering Ilir, Kayuagung 30618, Indonesia⁴Department of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, IPB University, Bogor 16680, Indonesia

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ABSTRACT

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Fiddler crabs utilize bioactive compounds for defense against environmental stressors. The study aimed to determine the antioxidant activity, bioactive compound profile of fiddler crab extracts as a form of self-defense against various anthropogenic activities along urban rivers. The fiddler crabs (*Uca spp.*) were collected from the Tanjung Api-Api Port area and Sungsang Village, located in Banyuasin Regency, South Sumatra, Indonesia. Fiddler crab samples were extracted by maceration in ethanol. The antioxidant activity of the extracts was evaluated using the 2,2-diphenyl-1-picryl hydrazyl (DPPH) radical scavenging assay. Bioactive compounds profile was determined by qualitative phytochemical screening, followed by gas chromatography-mass spectrometry (GC-MS). Fiddler crab extracts of samples obtained from both locations exhibited weak antioxidant activity with IC₅₀ values of 174.617 µg/mL and 190.786 µg/mL for crab extracts from Tanjung Api-Api area, and Sungsang village, respectively. Phytochemical screening of crab extract from Tanjung Api-Api area revealed the presence of alkaloid, triterpenoids, and saponins. GC-MS analysis identified hexadecanoic acid, trans-13-octadecenoic acid, (E)-9-octadecenoic acid ethyl ester, and cholesterol as the major bioactive compound groups in Tanjung Api-Api Fiddler crab extract. This findings suggest that fiddler crabs produce bioactive chemicals that could help combat oxidative stress caused by pollutants in urban rivers. Further research is needed to characterize these compounds in greater depth and explore their mechanisms of facilitating the adaptation of fiddler crabs to stressful environmental conditions.

Keywords: Antioxidant, Biochemical Profile, Fiddler Crabs, Anthropogenic, Urban Rivers.

Introduction

Increased urbanization and anthropogenic activity along urban rivers have led to a decline in environmental quality and aquatic ecosystem health.^{1,2} Water pollution, industrial waste discharges, and other chemical contaminants pose a serious threat to the organisms living in these ecosystems.^{3,4} Pollutants such as heavy metals, pesticides, and harmful organic compounds can enter aquatic systems.^{5,6} These pollutants can accumulate in sediments and aquatic organisms, causing cellular damage, reproductive impairment, and even death.⁷ Compounds like polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and other industrial chemicals have the potential to induce oxidative stress in living organisms. This can result in inflammation, tissue injury, and disruption of normal physiological functions.⁸⁻¹⁰ Among aquatic organisms, crustaceans are important creatures exposed to environmental pollutants.¹¹⁻¹³ Crabs being one of the most dominant groups, tend to accumulate significant amounts of pollutants due to their close association with the substrate in contrast to pelagic fauna that live in the water column.¹⁴⁻¹⁶

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One genus that is often found in estuarine and estuary habitats is the fiddler crab.^{17,18} Fiddler crabs a type of semi-terrestrial crustacean are commonly found along the coasts of tropical, subtropical, and warm temperate regions worldwide.^{19,20} These crabs are resilient ecosystem components because they can adapt to a wide range of habitat conditions, polluted, brackish, and saline environments.^{21,22} They play important ecological roles, including nutrient cycling, organic matter decomposition, and as a food source for various predators (birds, fish, and marine mammals).^{23,24} Fiddler crabs are recognized as ecosystem engineers because of their influence on sediment composition and their impact on the biodiversity of mangrove ecosystems.²⁵ However, changes in water quality due to human activities have caused various challenges to their survival.^{26,27} Fiddler crabs play important roles in coastal ecosystems, including inorganic matter decomposition and as a food source for various predators.^{28,29} To survive in contaminated environments, fiddler crabs may have developed physiological and biochemical adaptations, including enhanced antioxidant responses and unique biochemical defense mechanisms.^{30,31} Antioxidants are molecules that can scavenge free radicals, thereby preventing cellular damage caused by oxidative stress.^{32,33} In a polluted environment, the antioxidant defense system of fiddler crabs becomes very important to protect them from the damaging effects of chemical pollutants.^{34,35} In addition, biochemical compounds, which are natural chemical components in organisms, can play a key role in biological defense mechanisms.^{36,37} The biochemical profile of fiddler crabs, particularly their antioxidant and detoxification pathways, is crucial in mitigating oxidative stress and neutralizing pollutants. Flavonoids, terpenoids, and alkaloids are known for their antioxidant, anti-inflammatory, and other medicinal properties, which could help fiddler crabs adapt to polluted environments.³⁸⁻⁴⁰

Research on the antioxidant activity and biochemical profile of fiddler crabs in urban rivers can provide important insights into how these organisms adapt to environmental stresses caused by human activities. This knowledge is not only beneficial for fiddler crab species conservation, but it can also provide indicators of ecosystem health and potential pollution mitigation strategies. This study aimed to explore the antioxidant activity and biochemical profile of fiddler crabs as a form of self-defense against various anthropogenic activities along urban rivers. Understanding their biochemical adaptations allows us to better appreciate the complexity of interactions between organisms and their environment and develop more effective approaches to protecting and managing urban aquatic ecosystems.

Materials and Methods

Sampling area

Fiddler crabs were collected in December 2022 around the mangrove ecosystem area of Tanjung Api-Api Port and Sungsang Village, Banyuasin, South Sumatra (Figure 1). Tanjung Api-Api is surrounded by an extensive mangrove ecosystem that provides important habitats for various types of flora and fauna (fiddler crabs).^{32,41,42} In addition, Sungsang Village is surrounded by dense mangrove ecosystem, which are ideal habitats for fiddler crabs and various other marine species.⁴³⁻⁴⁵ The mangrove ecosystem at these two sites are important habitats for fiddler crabs (*Uca spp.*), which are known for their unique behaviors, such as burrowing in mangrove mud, and their important role in the ecosystem as bioindicators of environmental health. According to Marochi *et al.* (2022)⁴⁶, fiddler crabs usually inhabit mangrove habitats. Due to the uneven distribution of mangroves, understanding their connectivity and identifying local endemism is essential.

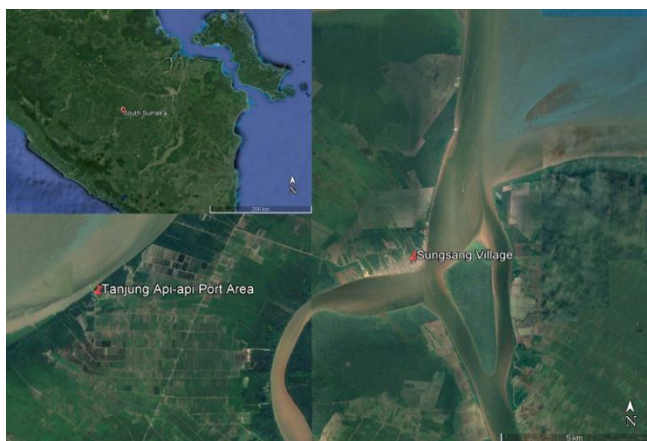


Figure 1: Map of sampling locations in Tanjung Api-Api Port area and Sungsang Village, Banyuasin District, South Sumatra, Indonesia.¹⁴⁸

Environmental quality measurement

The condition of the aquatic environment at the sampling site was measured using multiparameters, including dissolved oxygen (DO), salinity, pH, and temperature parameters.⁴⁷ Environmental parameters were assessed using a multiparameter device (Hanna HI 9829-01042, USA), and salinity was analyzed with a portable refractometer (ATC Portable, China).

Preparation of fiddler crabs

The sample preparation process was done according to the method described by Hamdi *et al.* (2020)⁴⁸ with modification. Fiddler crabs were cleaned from dirt using running water, followed by separation of the shell from the meat, and then oven-dried at 40°C. The dried sample was thereafter pulverized with the aid of an electric blender.

Determination of weight loss on drying

Briefly, samples were weighed before and after drying in an oven at 40°C until a constant weight was achieved. The percentage of weight loss was then calculated.

Extraction of fiddler crabs

The dried powdered sample (500 g) was macerated in 2 L of ethanol (≥96% purity, Merck, Germany) at room temperature for 24 h. The extract solution was subsequently filtered through Whatman 40 filter paper (Whatman International Ltd, UK). The resulting extract was then subjected to evaporation using a rotary evaporator (DLAB RE100-Pro, China) at 40°C until the solvent has completely evaporated, yielding a concentrated paste. The percentage yield of the extract was calculated. This temperature is carefully selected to avoid degrading the compounds present in the extract⁴⁹.

Determination of antioxidant activity

The antioxidant activity of the Fiddler crab extract was determined using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay as previously described with slight modification.⁵⁰⁻⁵² DPPH stock solution (0.1 mM) was made by dissolving 0.002 g of DPPH crystals (Merck, Germany) in 50 mL of ethanol. Different concentrations (2000, 1000, 500, 250, 125, and 62.5 ppm) of the crab extract were prepared in ethanol, and 1 mL of the extract solution was added to 1 mL of 0.1 mM DPPH solution, followed by the addition of 1 mL of 96% ethanol in a vial. The mixture was vortexed, then incubated at room temperature in the dark for 30 minutes. The absorbance of the reaction mixture was measured at 517 nm using a UV-Vis spectrophotometer (Shimadzu UV-1900, Japan). Ascorbic acid at same concentrations as the extract was used as the reference standard. The percentage inhibition of DPPH radical was calculated using the formula below (Equation 1).

$$\% \text{ inhibition} = \frac{\text{blank abs} - \text{sample abs.}}{\text{blank abs}} \times 100 \dots\dots\dots (1)$$

The antioxidant capacity of the extract was reported in terms of IC₅₀, which refers to the concentration in mg/mL of the extract required to reduce DPPH radical by 50%^{53,54}.

The IC₅₀ value was obtained from a linear regression equation (Equation 2) of the plot of sample concentration (x-axis) versus the percentage inhibition of DPPH radical (y-axis).⁵⁵

$$Y = ax + b \dots\dots\dots (2)$$

Phytochemical analysis

Fiddler crab extract was subjected to qualitative phytochemical tests for alkaloids, flavonoids, saponins, tannins, and terpenoids/steroids according to standard procedures⁵⁶⁻⁵⁸.

Gas chromatography-mass spectrometry (GC-MS) analysis

The chemical profile of fiddler crab extract was determined by GC-MS analysis as described previously.^{59,60} The GC-MS analysis was conducted using a Shimadzu QP2010 Plus (Shimadzu Corp., Japan), equipped with a Rxi-5ms capillary column (30 m × 0.25 mm i.d., 0.25 μm film thickness). Briefly, a 1 μL sample was injected into the column, with helium used as the carrier gas at a flow rate of 1 mL/min, and the split ratio was 1:50. The temperature program for the oven started at 50°C for an initial 5 minutes, followed by a gradual increase of 5°C per minute until 280°C was reached, and held for 5 minutes. The MS transfer line was maintained at 200°C. The ionization mode used was electron ionization at 70eV and source temperature of 280°C. Compound identification was assessed using Total Ion Count (TIC). The spectra of the separated compounds were compared with the database of the NIST Reference Spectra Library. The relative percentage composition of the identified compounds was estimated from the GC peak area percentage.

Results and Discussion

Environmental quality

The growth and development of fiddler crabs in estuary waters are ecologically influenced by the quality of the aquatic environment. Study on antioxidant activity in fiddler crabs must consider water quality because these factors have a direct effect on the physiological and biochemical conditions of animals. Temperature, salinity, pH, and DO not only affect the health and growth of marine organisms, but they also

determine their ability to produce and store bioactive compounds.⁶¹⁻⁶³ The aquatic environmental quality parameters including DO, pH, temperature, and salinity are presented in Table 1.

Table 1: Environmental quality of the sampling sites

Location	Environmental quality parameter			
	DO (mg/L)	pH	Temperature (°C)	Salinity (PSU)
Sungsang Village	6.83	7.13	31	12
Tanjung Api-Api Port	6.94	7.3	31.5	10

Based on environmental quality measurements, both sites showed DO levels > 5 mg/L. Most aquatic organisms depend on oxygen for survival and cannot endure for extended periods in water with DO levels below 5 mg/L.⁶⁴ Low DO levels significantly affect aquatic organisms, influencing respiration rates and overall survival.⁶⁵⁻⁶⁷ DO is an important indicator for water quality, as aquatic organisms depend on oxygen for respiration.^{68,69} DO values in Sungsang Village and Tanjung Api-Api Port area indicate an environment that supports the survival of aquatic organisms such as fish and fiddler crabs.

The pH levels at both sites suggest neutral to mildly alkaline water conditions, with a pH range between 6.5 and 8.5 which is generally considered safe for most aquatic organisms.⁷⁰ The pH values at Sungsang Village and Tanjung Api-Api Port are within the ideal range, indicating that there is no significant acidic or alkaline contaminants at these two sites. The causes of drastic changes in pH are pollution sources such as industrial waste, domestic waste, and agricultural watercourses that contain hazardous chemicals.⁷¹⁻⁷³ The temperature at both sites was around 31°C. This temperature is within the range generally found in tropical waters. A stable water temperature that matches the thermal tolerance of aquatic organisms is essential for their physiological processes, including metabolism and reproduction.^{74,75} Extremely high or low temperatures can lead to thermal stress in aquatic organisms.^{76,77} Temperature stability is essential for the physiological processes of aquatic organisms, including metabolism and reproduction.⁷⁸ Elevated temperatures can accelerate metabolism, reduce oxygen availability, and affect sexual maturity. Salinity of Sungsang Village water sample was slightly higher (12 PSU) compared to that of Tanjung Api-Api Port (10 PSU). Both values indicate slightly brackish water conditions, which are common in estuarine habitats. Salinity affects the distribution and adaptation of aquatic organisms.⁷⁹ Results from previous studies have shown that fiddler crabs exhibit higher physiological tolerance to increased salinity levels, supporting their osmoregulatory capabilities.^{80,81}

Environmental quality is a key determinant of the survival and biological activities of fiddler crabs. Adequate DO enhances respiratory efficiency, a neutral to slightly alkaline pH stabilizes the chemical environment, temperature stability prevents thermal stress, and optimal salinity ensures osmoregulation. Monitoring these parameters is important because significant fluctuations could signal environmental changes due to anthropogenic activities.^{41,82}

Description of fiddler crabs

The fiddler crab has an intact exoskeleton with a robust carapace, large chelipeds, and specialized legs adapted for sandy or muddy environments (Figure 2). Fiddler crab males are characterized by a large and strong body, which is adapted for various functions, such as attracting females and defense. The carapace surface is hardened, featuring distinct textures and colour patterns that enhance camouflage and provide mechanical protection from predators and environmental stressors.



Figure 2: Body shape of the fiddler crab (*Uca spp.*). (A) Full body, (B) Claws, and (C) Carapace

Based on the observations from the present study, the fiddler crabs discovered were *Uca spp.* Commonly found in estuarine environments like salt marshes and mangroves, play a significant role in ecosystem engineering and are recognized for their distinct sexual dimorphism.⁸³ Male crabs have one large cheliped, while females have two equally-sized chelipeds.⁸⁴⁻⁸⁶ Male crabs use their large chelipeds to attract females and compete with fellow males, while female crabs invest more energy in reproduction than growth.⁸⁷

Fiddler crabs construct above-ground sediment structures made of mud or sand, located within or slightly above the tidal zone.⁸⁸ Male crabs use their large chelipeds for visual signals and other vibratory behaviors to repel intruders or attract females.^{83,89,90} Fiddler crab carapace and claw coloration have three main functions: thermoregulation, camouflage, and intraspecific communication.^{91,92}

Feeding behavior analysis reveals that fiddler crabs primarily consume organic material, including bacteria and microalgae, obtained from mangrove sediments.²⁵ Mud fiddler crabs actively separate detritus from mineral particles, contributing to sediment aeration and organic matter decomposition.^{93,94} Fiddler crabs face daily and seasonal variations in salinity, temperature, and environmental contamination, making them an attractive model for studying the biochemical mechanisms of environmental adaptation.⁹⁵⁻⁹⁷ Due to their territorial nature, and lack of mobility, fiddler crabs are vulnerable to chronic environmental pollution.⁹⁸ Exposure of fiddler crabs to extreme tidal conditions and elevated temperatures can induce dehydration, oxidative stress, and metabolic impairment, leading to reduced survival rates.^{99,100}

Characteristics of fiddler crab extract

The weight loss of fiddler crabs was higher in the samples collected from Tanjung Api-Api Port area with a percentage weight loss of 77.72%, while the samples from Sungsang Village had a percentage weight loss of 74.65% (Table 2).

Table 2: Weight loss of fiddler crabs

Location	Sample weight (g)		Weight loss (%)
	Wet	Dry	
Sungsang Village	200	50.7	74.65
Tanjung Api-Api Port	100	22.28	77.72

This weight loss is primarily due to the high water content of crabs. Environmental factors such as DO, pH, temperature, and salinity, as well as environmental stress from human activities, may have contributed to this difference. The lower salinity in Tanjung Api-Api Port may cause the crabs to absorb more water to maintain osmotic balance, resulting in higher weight shrinkage when dried. It has been opined that salinity fluctuations affect the physiology of aquatic organisms.¹⁰¹ In addition, slightly higher temperatures can increase

metabolism and water evaporation from the crab's body.^{99,102} Variations in pH and DO levels also influence crab adaptation and health, affecting physiological responses to environmental stress.¹⁰³ The fiddler crab extraction process using ethanol resulted in a higher extract yield (15.75%) in the crab sample collected in Tanjung Api-api port area compared to that of Sungsang Village sample which produced an extract yield of 13.75% (Table 3).

Table 3: Percentage yield of fiddler crab ethanol extract

Location	Sample weight (g)		Percentage yield (%)
	Dry powder	Crude extract	
Sungsang Village	20	2.75	13.75
Tanjung Api-Api Port	20	3.15	15.75

This difference is likely due to variations in environmental factors, such as water quality and food availability. Solvent type, extraction conditions (temperature, duration, solvent-to-sample ratio), and crab biochemical composition has been shown to significantly influence extraction efficiency.¹⁰⁴ For instance, ethanol as a polar solvent is widely used to extract bioactive compounds,^{105,106} and has been shown to be effectiveness in isolating various biochemicals in good yield.¹⁰⁷ Optimized extraction conditions enhance bioactive compound recovery, improving extract yield and chemical quality.^{108,109}

Antioxidant activity in fiddler crabs

The results of the antioxidant activity test on fiddler crabs from two different areas, namely Sungsang Village and Tanjung Api-api Port are presented in Figure 3. The crab samples from both locations were found to possess weak antioxidant activity based on their IC₅₀ values. The IC₅₀ values of the crab extracts from Sungsang village and Tanjung Api-Api Port area were 190.786 µg/mL and 174.617 µg/mL.

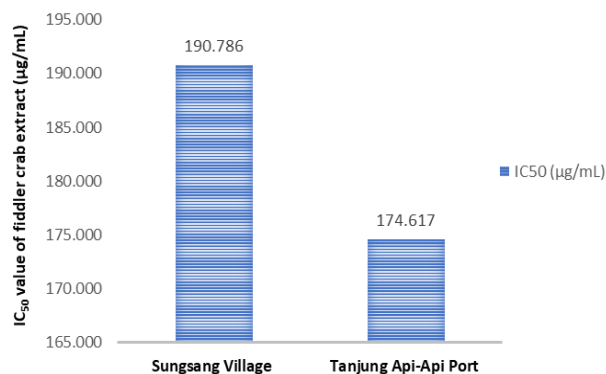


Figure 3: Antioxidant activity of fiddler crab ethanol extract

High IC₅₀ values suggest that a higher concentration of the extract is needed to inhibit 50% of DPPH free radicals, implying a lower level of antioxidant activity. These results may have been influenced by environmental factors such as pollution levels, pollutants, and habitat conditions. A previous report on the antioxidant activity of *Anadara granosa* from Sungsang village area revealed a strong activity with IC₅₀ value of 85 µg/mL.⁵³ As for the Tanjung Api-Api Port area, a weak antioxidant activity was found for mangrove species *Avicennia marina* with IC₅₀ value of 171.160 µg/mL, a moderate activity for *Bruguiera gymnorhiza* with IC₅₀ of 105.090 µg/mL, and a strong activity for *Sonneratia alba* with IC₅₀ of 28.064 µg/mL.³² The difference may be due to different species and changing environmental conditions. The marked difference between the two areas may be due to variations in pollution levels and the types of pollutants present. Tanjung Api-Api Port is likely to have higher pollution levels due to intense port activities and vessel traffic, which can produce various pollutants, including heavy metals and toxic organic compounds.^{44,110} Changes in an

organism's antioxidant capacity have a significant impact and have been regarded as a marker for assessing environmental pollution in aquatic ecosystems resulting from human activities.¹¹¹

Fiddler crabs living in an area may be exposed to various pollutants that can induce oxidative stress and damage their natural antioxidant capacity. Previous research has reported that there has been heavy metal pollution in the Tanjung Api-api Port area, with lead (Pb) concentration in sediment ranging from 7.0104 to 11.8186 mg/kg, and copper (Cu) concentration ranging from 3.7127 to 4.5347 mg/kg.²⁷ Heavy metal contamination in biological and environmental samples has been widely studied due to its potential health risks. A study on RUZU bitters, a polyherbal extract with antidiabetic properties, reported the presence of heavy metals such as Cr (1.09 mg/L), Zn (0.10 mg/L), Fe (2.10 mg/L), Mn (0.23 mg/L), Cu (0.20 mg/L), Cd (0.06 mg/L), and others, but Pb and Cd were found to be absent.¹¹² Various studies have highlighted that oxidative stress in organisms, caused by pollutant exposure, can impair the immune function of mud crabs by damaging the hepatopancreas, triggering antioxidant enzyme activity, and affecting immune gene expression.¹¹³ A research report explained that exposure to heavy metals leads to the accumulation of reactive oxygen species (ROS) in marine decapods, surpassing the capacity of antioxidant enzymes to neutralize them.¹¹⁴ It has also been reported that the effects of persistent organic pollutants in the cellular defense mechanisms and physiological functions in crustaceans differ based on the compound, tissue, and species involved.¹² In addition to pollutant-induced factors, variations in diet and the nutrient content of their habitat may also play a role in low antioxidant activity.¹¹⁵⁻¹¹⁷

Phytochemical constituents of fiddler crab extract

The crude ethanol extracts of fiddler crabs with the stronger antioxidant activity from both areas were subjected to phytochemical tests. From the results of the phytochemical screening, fiddler crabs from the Tanjung Api-api harbor contained a group of bioactive compounds, including saponins, terpenoids, and alkaloids (Table 4).

Table 4: Phytochemical compounds of fiddler crab ethanol extract from Tanjung api-api port area

Phytochemical	Inference
Alkaloids	+
Flavonoids	-
Terpenoids	+
Steroids	-
Saponins	+
Tannins	-

‘+’ indicates presence of pytoconstituents;

‘-’ indicates absence of pytoconstituents

These compounds are known to have various beneficial biological activities. Alkaloids are known to have various pharmacological effects including antimicrobial, anticancer, and antioxidant activities.^{118,119} Terpenoids are also recognized for their anti-inflammatory and anticancer activities.¹²⁰⁻¹²² On the other hand, saponins are reported to have antimicrobial, anti-inflammatory, and antifungal activities.¹²³⁻¹²⁵ The presence of these compounds in fiddler crabs indicates their potential as a source of biologically active compounds with applications in various medical and industrial fields.

However, the preliminary phytochemical tests were unable to detect the presence of flavonoids, steroids, and tannins in the crab extract from Tanjung Api-api harbor. Flavonoids are commonly present in a range of plants and are known to have strong antioxidant activity.^{126,127} The absence of flavonoids may be due to environmental factors or the type of diet of fiddler crabs in the Tanjung Api-Api Port area, which may not support flavonoid biosynthesis. Steroids and tannins were also not detected, although previous studies reported them to have important roles in various biological activities (anti-inflammatory and antimicrobial), this could be due to species-specific metabolic

variations or differences in extraction efficiency using ethanol as a solvent.¹²⁸⁻¹³⁰

Compounds identified from the GC-MS analysis of fiddler crab extract
GC-MS analysis was conducted on fiddler crab samples collected from the Tanjung Api-Api Port area, which demonstrated higher antioxidant activity compared to that of Sungsang Village. The following classes of compounds were detected; alcohols, aliphatic amines, lactones, alkaloids, sugars, esters, steroids, ketones, and organic fatty acids. The compounds identified were determined by comparing the height of the chromatogram peaks and the mass spectra data of the chromatogram peaks with those in the WILEY 7 database library. The GC-MS analysis of the fiddler crab extract identified 13 secondary metabolites, with hexadecanoic acid and its derivatives, as well as unsaturated fatty acids such as trans-13-octadecenoic acid and (E)-9-octadecenoic acid ethyl ester, and cholesterol constituting the major compounds (Figure 4, Table 5). The presence of these compounds suggests that fiddler crabs from this pollution-exposed area have developed biochemical adaptations to harsh environmental conditions. In addition, these compounds have shown potentially significant biological activities. The presence of the compound 2-Piperidinone, which belongs to the alkaloid group,^{131,132} suggests that these crabs may have developed chemical defense mechanisms to fight predators or pathogens in polluted environments. Alkaloids are known to have antimicrobial and antiparasitic properties,^{133,134} which may help the crab defend itself in environmental conditions that may be rich in pathogenic microorganisms.

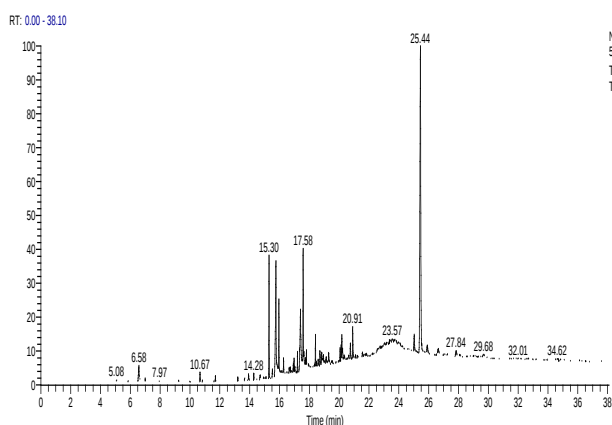


Figure 4: GC-MS chromatogram of fiddler crab extract from Tanjung Api-Api Port area

The presence of fatty acids such as hexadecanoic acid and its derivatives, as well as unsaturated fatty acids such as trans-13-octadecenoic acid and (E)-9-octadecenoic acid ethyl ester may suggest an adaptation of the crab to oxidative stress that may be caused by pollutants. These compounds are recognized for their anti-inflammatory and antioxidant activities,¹³⁵⁻¹³⁷ and may help reduce cellular damage due to chemical and heavy metal pollutants that may be present in the harbor area. In addition, compounds such as arachidonic acid and eicosapentaenoic acid (EPA), which belong to the omega-3 fatty acid group, can help reduce cellular damage due to chemical pollution and heavy metals that may be present in the harbor area.^{138,139} These fatty acids also have an important role in reducing inflammation and maintaining cell membrane integrity,^{140,141} especially for crabs living in habitats that may be exposed to oil pollution and other chemicals. The high cholesterol content (40.32%) in this extract suggests an important adaptation in maintaining the composition and role of cell membranes under environmental stress conditions. Cholesterol helps to maintain cell membranes and protect cells from damage caused by pollutants and drastic environmental changes.^{142,143} Environmental conditions with high pollution levels due to port activities and ship traffic,^{144,145} may be the main factor that encourages fiddler crabs to produce these bioactive compounds. Contaminants like heavy metals, petroleum, and industrial chemicals can cause oxidative stress and

damage crab cells, so crabs must develop chemical defense mechanisms to survive.^{114,146,147} Overall, these results suggest that fiddler crabs in the Tanjung Api-Api Port area have developed complex biochemical adaptations to deal with challenging environmental conditions. Further research is needed to characterize these compounds in greater depth and explore their mechanisms of facilitating the adaptation of fiddler crabs to stressful environmental conditions.

Table 5: Compounds identified from the GC-MS analysis of fiddler crab extract from Tanjung Api-Api Port area

Ret. time	Peak area %	Name of compound	Compound group
6.57	2.36	2-Piperidinone	Alkaloid
15.3	5.94	Hexadecanoic acid, methyl ester	Methyl palmitate
15.76	13.76	n-Hexadecanoic acid	Palmitic acid
15.96	4.1	Hexadecanoic acid, ethyl ester	Ethyl palmitate
17.4	9.11	trans-13-Octadecenoic acid	Fatty acid
17.58	7.92	(E)-9-Octadecenoic acid ethyl ester	Fatty acid ester
18.41	2.14	Arachidonic acid	Polyunsaturated fatty acid
18.83	1.66	cis-5,8,11,14,17-Eicosapentaenoic acid	Omega-3 fatty acid
23.57	1.44	9-Octadecenoic acid, 1,2,3-propanetriyl ester, (E,E,E)-	Triglyceride
23.74	2.37	Hexadecenoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester	Glyceride
25.03	2.14	1-Heptatriacotanol	Alcohol
25.44	40.32	Cholesterol	Sterol
26.65	1.61	Ethyl iso-allocholate	Bile acid derivative

Conclusion

Fiddler crabs collected from Tanjung Api-api Port and Sungsang village were found to possess weak antioxidant activity. Phytochemical screening of the crab extract from Tanjung Api-api harbor revealed the presence of alkaloids, terpenoids, and saponins. GC-MS analysis further revealed the presence of hexadecanoic acid, trans-13-octadecenoic acid, (E)-9-octadecenoic acid ethyl ester, and cholesterol as major compounds in fiddler crab extract from Tanjung Api-api harbor. These findings suggest that fiddler crabs have developed complex biochemical adaptations as a defense mechanism against various anthropogenic activities along urban rivers. The presence of these bioactive compounds may also have helped the crabs mitigate oxidative stress caused by pollutants, underscoring the significant impact of human activities on aquatic ecosystems and the adaptive responses of their inhabitants. Additional studies are required to thoroughly investigate the biological potentials of these compounds and their mechanisms of action in safeguarding against environmental stress.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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