

KONFIRMASI KE REVIEWER

Tropical journal of natural product research saat ini terindex

**SCOPUS Q4 DAN BER-IMPACT FACTOR (CiteScore Tracker 2023) di
SCOPUS 1.1),**

Data di scimago dan web journal tahun 2022, belum di update

Berikut saya lampirkan bukti dari web scopus

TERIMA KASIH BANYAK



Source details

Tropical Journal of Natural Product Research

CiteScore 2022

0.6



Scopus coverage years: from 2017 to Present

Publisher: Faculty of Pharmacy, University of Benin

SJR 2022

0.155



ISSN: 2616-0684 E-ISSN: 2616-0692

Subject area: Pharmacology, Toxicology and Pharmaceutics: Pharmaceutical Science

Medicine: Complementary and Alternative Medicine

Pharmacology, Toxicology and Pharmaceutics: Pharmacology

Chemistry: Analytical Chemistry

View all

SNIP 2022

0.268



Source type: Journal

[View all documents >](#)

[Set document alert](#)

[Save to source list](#)

[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

i Improved CiteScore methodology



CiteScore 2022 counts the citations received in 2019-2022 to articles, reviews, conference papers, book chapters and data papers published in 2019-2022, and divides this by the number of publications published in 2019-2022. [Learn more >](#)

CiteScore 2022

$$0.6 = \frac{568 \text{ Citations 2019 - 2022}}{891 \text{ Documents 2019 - 2022}}$$

Calculated on 05 May, 2023

CiteScoreTracker 2023 (Impact Factors di SCOPUS 1.1)

$$1.1 = \frac{1,386 \text{ Citations to date}}{1,257 \text{ Documents to date}}$$

Last updated on 05 March, 2024 • Updated monthly

CiteScore rank 2022

| Category | Rank | Percentile |
|--|----------|------------|
| Pharmacology, Toxicology and Pharmaceutics | #129/171 | 24th |
| Pharmaceutical Science | | |
| Medicine | #79/97 | 19th |
| Complementary and Alternative Medicine | | |

Q4

[View CiteScore methodology >](#) [CiteScore FAQ >](#) [Add CiteScore to your site](#)

About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

Language

[日本語版を表示する](#)

[查看简体中文版本](#)

[查看繁體中文版本](#)

[Просмотр версии на русском языке](#)

Customer Service

[Help](#)

[Tutorials](#)

[Contact us](#)

ELSEVIER

[Terms and conditions](#) ↗ [Privacy policy](#) ↗

All content on this site: Copyright © 2024 Elsevier B.V. ↗, its licensors, and contributors. All rights are reserved, including those for text and data mining, AI training, and similar technologies. For all open access content, the Creative Commons licensing terms apply.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies ↗.



TROPICAL JOURNAL OF
**NATURAL
PRODUCT
RESEARCH**
TJNPR

www.tjnpr.org VOL. 19(1), JAN 2017



**Tropical Journal of
NATURAL PRODUCT RESEARCH**

This journal is indexed in Open J-Gate,
Crossref, Creative Commons, Index
Copernicus, Google Scholar.

All published papers are DOI assigned.

Official Journal of Natural Product Research Group
University of Benin

Editor-in-Chief, Prof. Abiodun Falodun ([Profile](#))



Tropical Journal of Natural Product Research
Official Journal of Natural Product Research Group

ISSN: 2616-0684 (Print)
ISSN: 2616-0692 (Online)

[Home](#) / [Editorial Team](#)

Editorial Team

Editorial Board

Editor-in-Chief

Professor Abiodun Falodun

Professor of Pharmaceutical Chemistry

Natural product Research Group

University of Benin, Nigeria.

Email: editor.tjnpr@gmail.com; editor.tjnpr@uniben.edu

Phone: +2348073184488

Associate Editors:

- **Professor Dr. Dr. Peter Langer**, Institute of Organic Chemistry, University of Rostock, (Germany)
- **Professor Frederick O. Ekhaize**, Microbiology, University of Benin, Nigeria.
- **Professor Martins Emeje**: Professor of Drug Delivery/Nanomedicine in the Department of Pharmaceutical Technology and Raw Materials Development (PT&RMD) at the National Institute of Pharmaceutical Research and Development.

Editorial Assistant:

- **Erharuyi Osayemwenre**, Faculty of Pharmacy, University of Benin, Nigeria.

Board Members

- **Professor Ikhlas A. Khan**, National Center for Natural Product Research, Mississippi (USA)
- **Professor Nosa Egiebor**, College of Environmental Science & Forestry, State University of New York
- **Professor Samuel Qiu**, South China Botanical Gardens, Chinese Academy of Sciences (China)
- **Professor Xavier Barril**, De Fisicoquimica-Facultat De Farmacia Universitat de Barcelona, (Spain)
- **Professor Abiodun Ogundiani**, Pharmaceutical Chemistry, OAU, Ile-Ife, (Nigeria)
- **Professor Thomas Kodadek**, The Scripps Research Institute, Scripps Florida (USA)
- **Professor Anthony B Ebeigbe**, Physiology, College of Medical Sciences, University of Benin, (Nigeria)
- **Professor Eric KI Omogbai**, Pharmacology and Toxicology, University of Benin, Nigeria
- **Professor Dr. Udo Kragl**, Institute of Organic Chemistry, University of Rostock, (Germany)
- **Professor Cyril O. Usifoh**, Faculty of Pharmacy, University of Benin, Nigeria.
- **Professor Azuka C Opara**, Clinical Pharmacy & Pharmacy Practice, University of Benin, (Nigeria).
- **Professor Ikhide G. Imumorin**, Biological Sciences, Georgia Institute of Technology, Atlanta (USA)
- **Professor Mark T. Hamann**, Medical University College, South Carolina (USA)
- **Professor Barbara Nebe**, University of Rostock, (Germany)
- **Professor Anthony I. Okoh**, University of Fort Hare, Alice (South Africa)
- **Professor Dr. M. Iqbal Choudhary**, HEJ, University of Karachi, (Pakistan)
- **Professor Omoanghe S. Isikhuemhen**, North Carolina A&T State University, (USA)
- **Professor Ezekiel Green**, University of Johannesburg, (South Africa)
- **Professor John Igoli**, Strathclyde Institute of Pharmacy and Biomedical Sciences, UK
- **Professor Peter Akah**, Pharmacology & Toxicology, University of Nigeria, Nigeria
- **Professor H.A.B. Coker**, Faculty of Pharmacy, University of Lagos (Nigeria)
- **Dr Kingsly Agho**, School of Science and Health, Western Sydney University (Australia)
- **E. Igbiosa**, Microbiology, University of Benin, Nigeria
- **Pius Fasinu**, School of Pharmacy, Campbell University (USA)
- **Professor Larry A Walker**, National Center for Natural Products Research, Mississippi, USA
- **Dr. Alireza Heidari**, Faculty of Chemistry, California South University (CSU), Irvine, California, USA

- **Professor Iyere O Onoagbe**, Faculty of Life Sciences, University of Benin, (Nigeria)
- **Professor Broderick Eribo**, Department of Biology, Howard University, Washington DC, (USA)
- **Professor Simon Gibbons**, School of Pharmacy, University College London, UK
- **Professor Masashi Mizuno**, Laboratory of Food & Nutritional Chemistry, Kobe University, Japan
- **Professor FBC Okoye**, Professor of Medicinal and Pharmaceutical Chemistry, Nnamdi Azikiwe University, Awka

**TROPICAL JOURNAL OF
NATURAL
PRODUCT
RESEARCH
TJNPR**

www.tjnpr.org

**Tropical Journal of
NATURAL PRODUCT RESEARCH**

This journal is indexed in Open J-Gate, Crossref, Creative Commons, Index Copernicus, Google Scholar.

All published papers are DOI assigned.

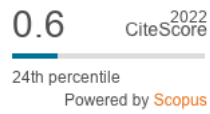
Official Journal of Natural Product Research Group
University of Benin



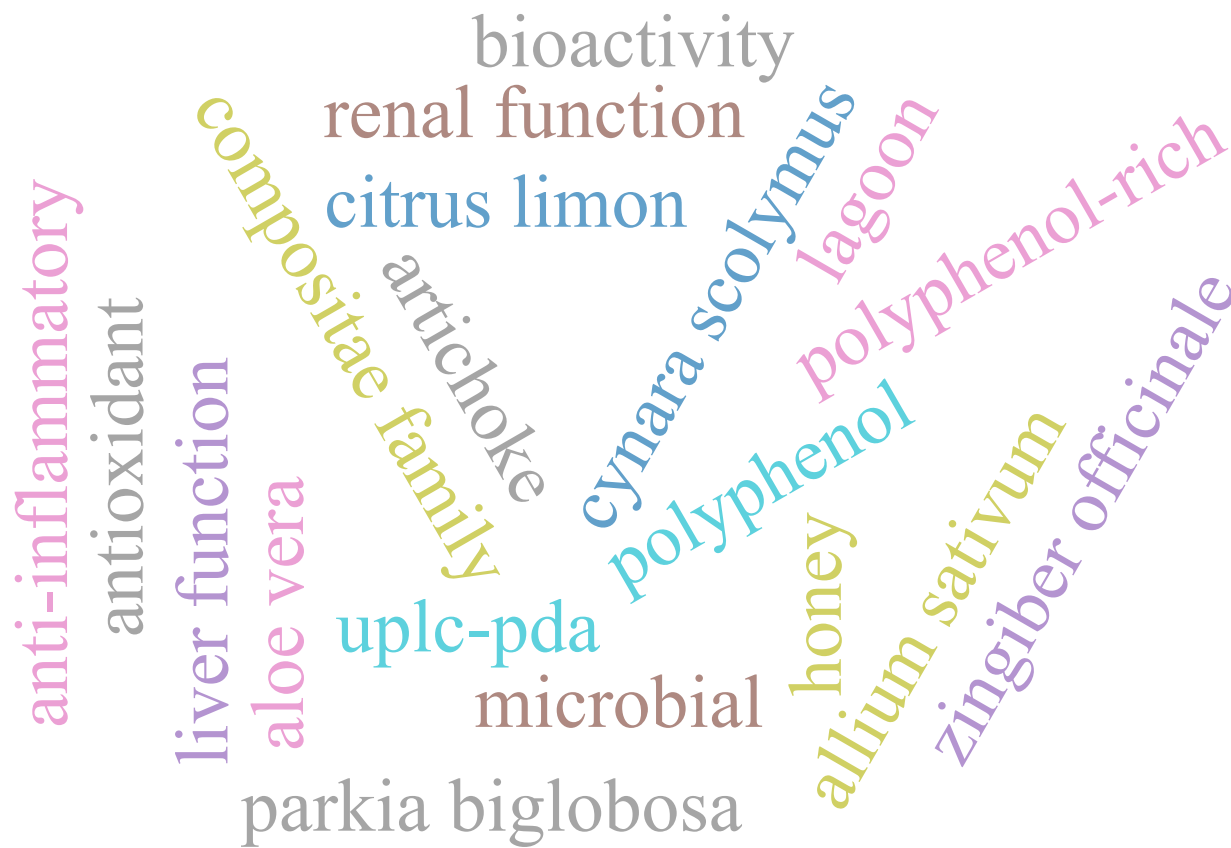


[More Graphical Abstracts](#)

Indexing & Abstracting



Keywords



ABOUT TJNPR

[About the Journal](#)
[Aims & Scope](#)
[Editor Profile](#)
[Editorial Board](#)

RESOURCES

[Editorial Policy & Malpractice Statement](#)
[Guide for Authors](#)
[Guidelines for Reviewers](#)
[Open Access Policy](#)

ACCOUNT

[Editor](#)
[Authors](#)
[Reviewers](#)
[Subscribers](#)

ISSUES

[Current](#)
[Archives](#)

Copyright © 2022 | Tropical Journal of Natural Product Research (TJNPR), All Right Reserved.



Editor-in-Chief, Prof. Abiodun Falodun ([Profile](#))



Tropical Journal of Natural Product Research
Official Journal of Natural Product Research Group

ISSN: 2616-0684 (Print)
ISSN: 2616-0692 (Online)

[Home](#) / [Archives](#) / Vol. 7 No. 9 (2023): Tropical Journal of Natural Product Research (TJNPR)

Vol. 7 No. 9 (2023): Tropical Journal of Natural Product Research (TJNPR)

Published: 2023-10-03

Articles



Chemical and Pharmacological Potential of *Adiantum philippense* Linn and Further Molecular Simulation Study of Its Compounds Against COX-2: An Unexplored Medicinal Fern

<http://www.doi.org/10.26538/tjnpr/v7i9.1>

Taslma Akhter, Nuraya Y. Bristy, Md. E. Shikdar, Ashit K. Dutta, Dipto K. Sarker, Khondoker S. Ahmed, Hemayet Hossain, Jamil A. Shilpi, Shaikh J. Uddin
3842-3855

[pdf](#)

[doi](#)

[epub](#)



Bioactive Compounds, Pharmacological Properties, and Utilization of Pomegranate (*Punica granatum L.*): A Comprehensive Review

<http://www.doi.org/10.26538/tjnpr/v7i9.2>

Jyoti Singh, Rasane Prasad, Hamita Preet Kaur, Kaushal Jajoria, Arshmindar Singh Chahal, Anjali Verma, Mohammed Kara, Amine Assouguem, Jamila Bahhou
3856-3873

[pdf](#)

[doi](#)

[epub](#)



A Review on the Nutritional Value and Health Benefits of Different Parts of Grape (*Vitis vinifera L.*)

<http://www.doi.org/10.26538/tjnpr/v7i9.3>

Jyoti Singh, Harmandeep Kaur, Rajdeep Kaur, Ritika Garg, Rasane Prasad, Amine Assouguem, Mohammed Kara, Jamila Bahhou
3874-3880

[pdf](#)[doi](#)[epub](#)

Antidiabetic and Anti-neuropathic Activities of Hydroalcoholic Polyherbal Extract in Wistar Rats

<http://www.doi.org/10.26538/tjnpr/v7i9.4>

Jhansi Lakshmi, Suhasin Ganta

3881-3886

[pdf](#)[doi](#)[epub](#)

Study of Weeds in Banana Cultivation in the Comoros Islands

<http://www.doi.org/10.26538/tjnpr/v7i9.5>

Houmrak Housseni, Beniaich Ghada, El Abdali Youness, Laabidi Abdelaaziz, Khadmaoui Abderrazzak, Fadli Mohamed

3887-3892

[pdf](#)[doi](#)[epub](#)

Antimalarial Activity of Crude Bark Extract of *Pterocarpus indicus* Willd. against *Plasmodium falciparum* Strain 3D7

<http://www.doi.org/10.26538/tjnpr/v7i9.6>

Diana Retnosari, Hery Purnobasuki, Agus Supriyanto

3893-3897

[pdf](#)[doi](#)[epub](#)

Anti-Mycobacterial Activity of Polycarpine and Polycarpaurine A from an Indonesia Marine Ascidian *Polycarpa* sp

<http://www.doi.org/10.26538/tjnpr/v7i9.7>

Wilmar Maarisit, Sonny D. Untu, Yessi K. Lengkey, Torry C.C Lomban, Jabes W. Kanter, Hiroyuki Yamazaki, Michio Namikoshi, Fitje Losung, Veibe Warouw, Remy E.P. Mangindaan

3898-3901

[pdf](#)[doi](#)[epub](#)



In-silico Evaluation of Hexagamavunon Analogs for Antibacterial Activity Against *Helicobacter pylori*

<http://www.doi.org/10.26538/tjnpr/v7i9.8>

Nurul Jannah, Rahmat A Hi Wahid

3902-3907

[pdf](#)

[doi](#)

[epub](#)



Cytotoxic Activity of Xanthenes from the Stem Bark of *Cratoxylum sumatranum*

<http://www.doi.org/10.26538/tjnpr/v7i9.9>

Shola Mardhiyyah, Mufidatuz Zakiyah, Erika D. Renata, Tjitjik S. Tjahjandarie, Unang Supratman, Rurini Retnowati, Ratih D. Saputri, Mulyadi Tanjung

3908-3910

[pdf](#)

[doi](#)

[epub](#)



Assessment of the Efficiency of Application of the National Protocol for Integrated Management of Severe Acute Malnutrition in National Hospital Center of Nouakchott -Mauritania

<http://www.doi.org/10.26538/tjnpr/v7i9.10>

Sima Boulebatt, Nada Belmejdoub, Fatima Aslaou, Hefdhallah Al-Aizari, Nasser Abdellahi, Ahmed Feil, Driss Belghyti

3911-3915

[pdf](#)

[doi](#)

[epub](#)



Coexistence of Cutaneous and Visceral Leishmaniasis in the Province of Moulay Yaâcoub, North-Central Morocco

<http://www.doi.org/10.26538/tjnpr/v7i9.11>

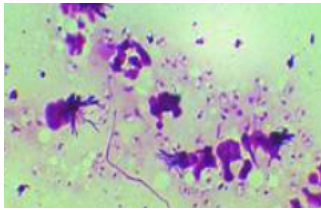
Khadija Lahouiti, Fatima Zahra Talbi, Mouhcine Fadil, Hajar El Omari, Nordine Nouayti, Omaima El Bouazzi, Fouad El-Akhal, Amal Taroq, Fatimaezzahra Mesbah, Rachid Benrezzouk, Essam Azami, Abdelkarim Taam, E Abdelhakim, Ouali Lalami

3917-3922

[pdf](#)

[doi](#)

[epub](#)



Determination of Photoprotective Capacity of Topical Gel Formulations Containing Bioactive Compound Rutin and Evaluation of Physicochemical Stability

<http://www.doi.org/10.26538/tjnpr/v7i9.12>

Melta A. Nadia, Abdul K. Zulkarnain, Teuku N. S. Sulaiman
3923-3931

[pdf](#)

[doi](#)

[epub](#)



Anti-inflammatory and Antioxidant Activities of Root Extract of *Morinda officinalis* from Quang Binh Province, Vietnam

<http://www.doi.org/10.26538/tjnpr/v7i9.13>

Thanh Pham, Thi Y. Van, Minh D. Tran, Dien Dinh, Thi H.Q. Hoang, Nam T. Tran
3932-3935

[pdf](#)

[doi](#)

[epub](#)



The Toxic Impact of Silver Nanoparticles Synthesized Extracellularly by *Aspergillus flavus* on Breast Cancer Cells (MDA-MB-231), as Well as Their Antibacterial Activity

<http://www.doi.org/10.26538/tjnpr/v7i9.14>

Ibrahim I. Alfarrayeh, Safa S. Al-Alwani, Yaseen T. Al Qaisi, Ahmad Z. Alsarayreh, Laila Al-Omari, Jehad F. Alhmoud
3936-3943

[pdf](#)

[doi](#)

[epub](#)



The Optimization of Encapsulation Mangosteen (*Garcinia mangostana* L.)-Gotu Kola (*Centella asiatica* L. Urban) Fraction Combination in Soybean Liposome by Response Surface Methodology

<http://www.doi.org/10.26538/tjnpr/v7i9.15>

Ryan Munandar, Khairul Anam, Dwi Hudiyantri
3944-3950

[pdf](#)

[doi](#)

[epub](#)



LC-MS Based Phytochemical Perspective, ACE Inhibition Potential and Pharmacokinetics Study of Humulus lupulus Flower Extract

<http://www.doi.org/10.26538/tjnpr/v7i9.16>

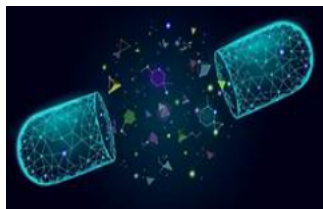
Tripti Singh, Ashwani Mathur

3951-3959

[pdf](#)

[doi](#)

[epub](#)



Synthesis of a Non-toxic Organic Ionic Liquid Triazole Derivative: Application in Inhibition against Corrosion Copper in a Neutral Chloride Environment

<http://www.doi.org/10.26538/tjnpr/v7i9.17>

Aomar Biari, Ahmed Dermaj, Mostafa Doubi, Hamid Erramli, Driss Chebabe, Abdelillah Shaim, Najat Hajjaji

3960-3967

[pdf](#)

[doi](#)

[epub](#)



Phytochemical Profiling and Antioxidant Activities of Red Ginger (*Zingiber officinale* var. *rubrum*) Cultivated Eco-Farming

<http://www.doi.org/10.26538/tjnpr/v7i9.18>

Rahmat A.Hi. Wahid, Okti Purwaningsih, Puguh B. Pamungkas

3968-3973

[pdf](#)

[doi](#)

[epub](#)



Moroccan Propolis: Unraveling the Phytochemical Diversity, Chemical Composition, and Antioxidant Potential Across Two Seasons

<http://www.doi.org/10.26538/tjnpr/v7i9.19>

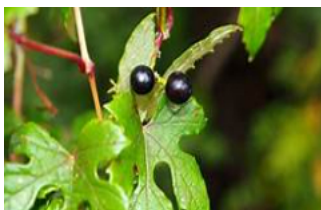
Karima E. Kabous, Mohammed Ouhsine

3974-3980

[pdf](#)

[doi](#)

[epub](#)



Phytochemical Screening, Antioxidant and Xanthine Oxidase Inhibitory Activities of *Vitis heyneana* Schult. Stem Extracts From Vietnam

<http://www.doi.org/10.26538/tjnpr/v7i9.20>

Linh K.H. Nguyen, Chen V. Tran, Nguyen D. Pham, Tan V. Tran

3981-3988

[pdf](#)

[doi](#)

[epub](#)



Ethanol extract of *Imperata cylindrica* Roots Potential as an Aphrodisiac in Male Wistar Rats

<http://www.doi.org/10.26538/tjnpr/v7i9.21>

I Nyoman G Wardana, I Gusti A Widiarti, I Nyoman M Karmaya, Jaqueline Sudiman Muliani

3989-3994

[pdf](#)

[doi](#)

[epub](#)



Method Development for Simultaneous Quantification of Polyphenol Compounds in Artichoke (*Cynara scolymus* L.) Leaf Dry Extract by UPLC-PDA

<http://www.doi.org/10.26538/tjnpr/v7i9.22>

Nguyet A.T. Nguyen, Tam M. Le, Hai T. Nguyen, Khanh H.T. Pham, Hieu P.C. Truong, Phuong D. Pham, Manh H. Tran

3995-4002

[pdf](#)

[doi](#)

[epub](#)



TLC-Densitometry Analysis Method of Asiaticoside Assay and Antioxidant Activity of *Centella asiatica* (L.) Urban Extract

<http://www.doi.org/10.26538/tjnpr/v7i9.23>

Agus Pratiwi, Retno Sari, Aty Widyawaruyanti

4003-4009

[pdf](#)

[pdf](#)

[epub](#)



Sea Cucumber Reduces Breast Cancer Tumor Size Through Inhibition of MMP9 Dependent HER2 Expression in Breast Cancer Mice Model

Dono Pranoto, Hana Ratnawati, Teresa L Wargasetia, Andri Octavallen, Mochamad A. A Rachmat
4010-4015

[pdf](#)[doi](#)[epub](#)

Plant-based Bioproducts for the Control of Diabetes and Hypertension in TangierTetouan Region (Morocco)

<http://www.doi.org/10.26538/tjnpr/v7i9.25>

Mabchour Insaf, Houzi Ghizlane, Beniaich Ghada, Elbattioui Fadoua, Kaouia Samiha, El abdali Youness, Fadli Mohamed
4016-4025

[pdf](#)[doi](#)[epub](#)

Hypoglycemic and Hypolipidemic Effects of Ethanol Extract of Pomegranate Peels, Rinds, and Seeds in Alloxan-Induced Diabetic Rats

<http://www.doi.org/10.26538/tjnpr/v7i9.26>

Khalid M. Alqaisi, Talal S. Al-Qaisi, Jehad F. Alhmoud, Husni S. Farah, Thamer A. Hamdan, Khaled A. Ahmed, Elsayed Elbadrawy
4026-4031

[pdf](#)[doi](#)[epub](#)

Chemical Composition and Biological Activities of Essential Oil from *Ocimum basilicum* L. Collected in Dak Lak, Vietnam

<http://www.doi.org/10.26538/tjnpr/v7i9.27>

Dam T. B. Hanh, Truong N. Ngu, Phan H. T. Bao, Trinh N. T. Vy, Nguyen T. V. Dung, Dang T. T. My, Le T. T. Loan, Do T. Lam, Phi H. Nguyen, Nguyen P. Khanh, Dao C. To
4032-4037

[pdf](#)[doi](#)[epub](#)



Immune-Enhancing Effect of Ethanol Extract of Rambutan (*Nephelium lappaceum* L.) Fruit Peel on phagocytosis index, Paw Edema Formation, and Antibody Titer in Mice

<http://www.doi.org/10.26538/tjnpr/v7i9.28>

Tanti A. Sujono, Diana Kamilia, Ambar S. Kinasih
4038-4042

[pdf](#)

[doi](#)

[epub](#)



Analysis of the Effects of Potassium Fertilization and Shade Level on Two Kencur Accessions' Yield Quality (*Kaempferia galanga* L)

<http://www.doi.org/10.26538/tjnpr/v7i9.29>

Eko Widaryanto, Akbar Saitama, Fathullah Zaini, Akbar H. Zaini, Oktavia R. Adianingsih
4043-4048

[pdf](#)

[doi](#)

[epub](#)



Chemical Composition, and Antibacterial and Antifungal Activities of Crude Extracts from *Pistacia lentiscus* L. Fruit

<http://www.doi.org/10.26538/tjnpr/v7i9.30>

Salwa I. A. Eltawaty, Mohammed B. Suliman, Sanadelaslam El-Hddad
4049-4054

[pdf](#)

[doi](#)

[epub](#)



Anti-Mycobacterial Activity of Polycarpine and Polycarpaurine A from an Indonesia Marine Ascidian *Polycarpa* sp.

<http://www.doi.org/10.26538/tjnpr/v7i9.31>

Wilmar Maarisit, Sonny D. Untu, Yessi K. Lengkey, Torry C.C Lomban, Jabes W. Kanter, Hiroyuki Yamazaki, Michio Namikoshi, Fitje Losung, Veibe Warouw, Remy E.P. Mangindaan
4055-4058

[pdf](#)

[doi](#)

[epub](#)



Preparation of Antibacterial Chitosan Membrane and Potential Application as Coating in Maintaining the Quality of Jackfruit

<http://www.doi.org/10.26538/tjnpr/v7i9.32>

Tran Bui-Phuc, Nguyen Dinh-Phong, Nguyen-Nhat, Le Thai-Hoang, Le-Thi Anh-Dao, Nguyen Cong-Hau
4059-4064

 pdf

 doi

 epub



Phytochemistry and Antitrypanosomal Effects of *Acacia nilotica*, *Tamarindus indica* and *Terminalia avicennioides* Using Drug Incubation Infectivity Test

<http://www.doi.org/10.26538/tjnpr/v7i9.33>

Abdullah M. Tauheed, Mohammed Mammam, Abubakar Ahmed, Bashir Ibrahim, Hadiza Aliyu-Amoo, Sakeena F. Yahaya, Emmanuel O. Balogun
4065-4069

 pdf

 doi

 epub



Phytochemical, Metal Analysis, and in-vitro Antioxidant Activity of Ethanol Leaf Extract of *Alchornea cordifolia* (Schumach and Thonn) Müll Arg (Euphorbiaceae)

<http://www.doi.org/10.26538/tjnpr/v7i9.34>

Sunday A. Ejeh, Hyacinth A. Abu, Patrick A. Onyeyili, Jerry N. Abenga, Raphael J. Ogbe, Samson E. Abalaka
4070-4075

 pdf

 doi

 epub



Extraction and Physicochemical Characterization of Starch from *Pterocarpus santalinoides* Seeds

<http://www.doi.org/10.26538/tjnpr/v7i9.35>

Sinodukoo E. Okafo, Clement O. Anie, Philip O. Moniuro, Lawrence U. Nwankwo
4076-4083

 pdf

 doi

 epub



Changes in Hepatic Function Indices in Ulcerated Rats Treated with *Persea americana* Seed and *Bryophyllum pinnatum* Leaf Ethyl Acetate Fraction

<http://www.doi.org/10.26538/tjnpr/v7i9.36>

Emeka S. Asiwe, Assumpta U. Ugenyi, Uchechi E. Enenebeaku, Peter O. Opara, Chinwe S. Alisi, Jervas Ekezie
4084-4091

[pdf](#)

[doi](#)

[epub](#)



Penicillium citrinum: A Promising Candidate for Protease Production

<http://www.doi.org/10.26538/tjnpr/v7i9.37>

Uchenna Oyeagu, Kingsley T. Ughamba, Ogechi H. Ekwem, Francis S. O. Ugwu, Chukwuemeka C. Ezeh
4092-4098

[pdf](#)

[doi](#)

[epub](#)



Host-Plant Species Effect on Anti-Diabetic Activity of African Mistletoe (*Loranthus bengwensis*) in STZ induced Diabetic Rats

<http://www.doi.org/10.26538/tjnpr/v7i9.38>

Ewenodere O. Bikomo, Sikiru A. Ojokuku, Ridwan A. Lawal, Adedoyin Dayo
4099-4102

[pdf](#)

[doi](#)

[epub](#)



Antiatherogenic and Antiobesity Effects of Aqueous Stem Bark Extract of *Grewia mollis* Juss (*Malvaceae*)

<http://www.doi.org/10.26538/tjnpr/v7i9.39>

Adarki W. Pongri, Ighodaro Igbe, Enitome E. Bafor
4103-4111

[pdf](#)

[doi](#)

[epub](#)

**Investigations of Ameliorative Potentials Extract of *P. pellucida* on Salt - Fructose Induced Dyslipidemia in Wistar Rats**

<http://www.doi.org/10.26538/tjnpr/v7i9.40>

Aderonke E Fakayode, Beatrice O Emma- Okon, Adetoun E. Morakinyo, Adeniyi O Fajobi, Kelechi N Akinyele, Oluokun O Oyedapo
4112-4116

[pdf](#)

[doi](#)

[epub](#)

**ERRATUM: Phytochemical, Antioxidant, and Cytotoxic Activity of Water Hyacinth (*Eichhornia crassipes*) Ethanol Extract**

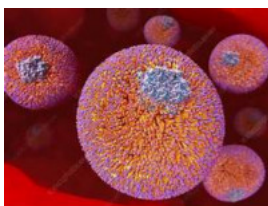
<http://www.doi.org/10.26538/tjnpr/v7i8.5>

Willy T Eden, Subagus Wahyuono, Edy Cahyono, Puji Astuti
3606-3612

[pdf](#)

[doi](#)

[epub](#)

**ERRATUM: Hypoglycemic and Hypolipidemic Effects of Ethanolic Extract of Pomegranate Peels, Rinds, and Seeds in Alloxan-Induced Diabetic Rats**

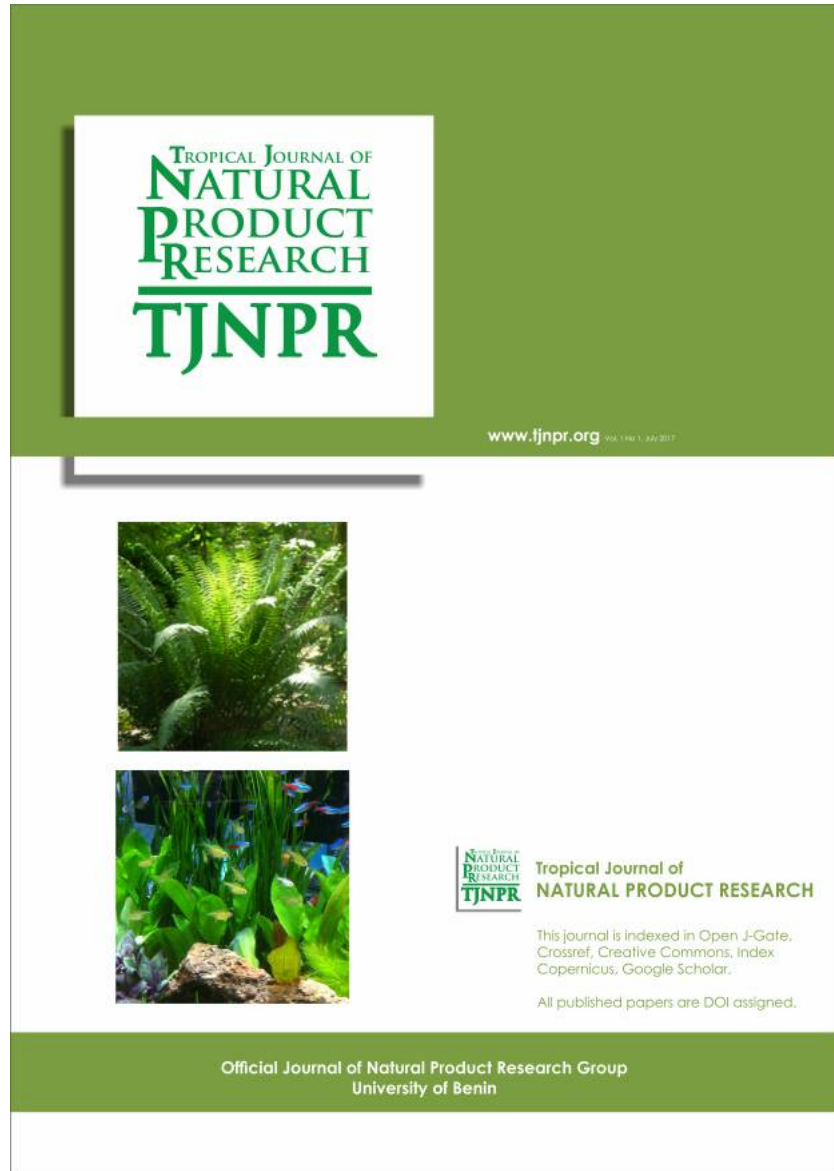
<http://www.doi.org/10.26538/tjnpr/v7i8.40>

Khalid M. Alqaisi, Talal S. Al-Qaisi, Jehad F. Alhmoud, Husni S. Farah, Thamer A. Hamdan, Khaled A. Ahmed, Elsayed Elbadrawy
3837-3842

[pdf](#)



[doi](#)

[epub](#)



**TROPICAL JOURNAL OF
NATURAL
PRODUCT
RESEARCH
TJNPR**

www.tjnpr.org ISSN 1943-1202



**Tropical Journal of
NATURAL PRODUCT RESEARCH**

This journal is indexed in Open J-Gate,
Crossref, Creative Commons, Index
Copernicus, Google Scholar.

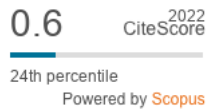
All published papers are DOI assigned.

Official Journal of Natural Product Research Group
University of Benin



[More Graphical Abstracts](#)

Indexing & Abstracting



Keywords



ABOUT TJNPR

- [About the Journal](#)
- [Aims & Scope](#)
- [Editor Profile](#)
- [Editorial Board](#)

RESOURCES

- [Editorial Policy & Malpractice Statement](#)
- [Guide for Authors](#)
- [Guidelines for Reviewers](#)
- [Open Access Policy](#)

ACCOUNT

- [Editor](#)
- [Authors](#)
- [Reviewers](#)
- [Subscribers](#)

ISSUES

- [Current](#)
- [Archives](#)

Copyright © 2022 | Tropical Journal of Natural Product Research (TJNPR), All Right Reserved.



**Ethanol extract of *Imperata cylindrica* Roots Potential as an Aphrodisiac in Male Wistar Rats**

I Nyoman G Wardana*, I Gusti A Widiyanti, I Nyoman M Karmaya, Muliani, Jaqueline Sudiman

Department of Anatomy, Faculty of Medicine, Universitas Udayana, Bali 80232, Indonesia

ARTICLE INFO**Article history:**

Received 17 July 2023

Revised 02 September 2023

Accepted 28 September 2023

Published online 01 October 2023

Copyright: © 2023 Wardana *et al.* This is an open-access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

ABSTRACT

The roots of *Imperata cylindrica* are used by many ethnic groups in Indonesia as an aphrodisiac. This study determined the aphrodisiac properties of the ethanol extract of *I. cylindrica* roots in male Wistar rats. The experimental animal was 25 male and 15 female Wistar rats aged 4 – 5 months. The male rats had at least two previous copulation experiences. The ethanol extract of *I. cylindrica* was administered orally to the treatment group for 28 days at 100, 200, and 400 mg/kg. The group given sildenafil citrate (5 mg/kg BW) and distilled water served as positive and negative controls, respectively. On day 29, the serum testosterone level and sexual behavior parameters (mounting and intromission latency, mounting and intromission frequency, ejaculation latency, and postejaculatory mounting interval) were observed and assessed. Administration of the ethanol extract of *I. cylindrica* roots for 28 days resulted in decreased mounting and intromission latency and increased mounting and intromission frequency at all doses. There was an increase in ejaculation latency at 100 and 200 mg/kg BW doses and a decrease in the postejaculatory mounting interval at 100 and 200 mg/kg BW doses. A 100 mg/kg BW dose approached the giving sildenafil effect (5 mg/kg BW) as a positive control. Serum testosterone levels increased at all doses of the extract. The ethanol extract of *I. cylindrica* roots has the potential to act as an aphrodisiac, with the possible mechanism of action being an increase in testosterone levels.

Keywords: aphrodisiac, root, *Imperata cylindrica*, ethanol extract, sexual behavior, herbal plants, testosterone

Introduction

Male sexual dysfunction refers to disturbances in the response to the sexual cycle, which encompasses drive/desire, arousal, and orgasm. Its prevalence is found to exceed 50% among men aged 40–70 years and tends to increase with age.¹ Erectile dysfunction disorders are found in 10%–20%, sexual drive disorders in ~8%–18%, and premature ejaculation disorders in ~30% of individuals.² In China, the reported prevalence of sexual dysfunction among married men aged 30–60 years with one or more symptoms was 15%. Additionally, the prevalence of decreased sex drive was 11.1%, erectile dysfunction was 4.3%, and premature ejaculation was 4.7%.³ At present, there is no reported prevalence of sexual dysfunction in Indonesia, except for erectile dysfunction, which has been reported at 35.6% (22.3% mild, 13.7% mild-moderate, 3.1% moderate, and 0.8% severe). The highest prevalence was observed among individuals aged ≥60 years, with a rate of 88.0%.⁴

Sexual dysfunction itself can have implications for infertility, well-being, interpersonal functioning, relationships with partners, and overall quality of life.⁵ Psychologically, the impact of sexual dysfunction in men is evident in the form of depression and anxiety. In a study involving 76 men with erectile dysfunction, with spinal cord injury, the incidences of depression and anxiety were reported at 16.47% and 58.7%, respectively.

*Corresponding author. E mail: mandewardana@unud.ac.id
Tel: +62361) 222510

Citation: Wardana ING, Widiyanti IGA, Karmaya INM, Muliani, Sudiman J. Ethanol extract of *Imperata cylindrica* Roots Potential as an Aphrodisiac in Male Wistar Rats. Trop J Nat Prod Res. 2023; 7(9): 3989-3994 <http://www.doi.org/10.26538/tjnpr/v7i9.21>

Official Journal of Natural Product Research Group, Faculty of Pharmacy, University of Benin, Benin City, Nigeria

Furthermore, in another study with 64 men experiencing erectile dysfunction and impaired sexual drive, without spinal cord injury, the depression and anxiety rates were 30.0% and 48.75%.⁶ The primary cause of male sexual dysfunction is a decline in testosterone levels within the blood circulation. Testosterone levels naturally decrease as men age, with a gradual decline of 0.4%–2% per year, starting at ~30 years of age. Among men aged 70 and above, ~35% have lower testosterone levels compared with younger men, and 13% of these individuals have hypogonadism. Late-onset hypogonadism (LOH) is the term used to describe male sexual dysfunction in people over 65 with low testosterone levels.⁷ Alongside diminished testosterone levels, sexual dysfunction in men can also be attributed to various factors, including diabetes mellitus, cancer, stroke, hypertension, depression, anxiety, and penile trauma.¹ Testosterone hormone replacement therapy remains the primary treatment choice for sexual dysfunction associated with LOH. However, excessive testosterone supplementation has been linked to breast cancer, prostate cancer, polycythemia, erythrocytosis, and severe obstructive sleep apnea.⁸ The high cost of this therapy poses a barrier for patients with limited incomes.⁹ In cases of erectile dysfunction, drugs from the phosphodiesterase-inhibitor class, such as sildenafil, vardenafil, and tadalafil, are commonly used for treatment.¹⁰ Nonetheless, the efficacy of conventional medications is limited, and there are contraindications in certain disease states and side effects, including headaches, dizziness, facial flushing, nasal congestion, dyspepsia, and visual changes such as photophobia, cyanopsia, and hazy vision, which can cause discomfort to users.¹¹

If sexual dysfunction is linked to the physiological processes of the sexual response cycle, dietary factors are just as essential as the widespread use of medicines to treat it. Sexual dysfunction can be reversed through modest lifestyle modifications and hormonal management. Implementing lifestyle changes, such as regular exercise and adopting a nutritious diet for weight loss, are key approaches to addressing sexual dysfunction.^{8,12} Providing specific nutrition can

contribute to an improved quality of life and enhanced sexual health. Herbal medicines, with aphrodisiac properties, can aid in this process.¹³ The utilization of herbal plants as aphrodisiacs for the treatment of sexual disorders is rising.¹⁴ Herbal plants with aphrodisiac properties are easily accessible and have minimal to no side effects.¹⁵ In Indonesia, besides ginger (*Zingiber officinale Roscoe*), areca nut (*Areca catechu*), long jack (*Eurycoma longifolia Jack*), and pepper (*Piper nigrum*), cogon grass roots (*Imperata cylindrica*) are widely used as an aphrodisiac by various ethnic groups. Specifically, 19 ethnic groups in Indonesia, namely Basap, Gayo, Pubian, Postejaculatory mounting intervalPeminggir, Sunda Priangan, Osing, Bawean, Madura, Baduy, Suaid, Dayak Tomum, Pitap, Dayak Bentian, Kutai, Dayak Bahau, To Manui'i, Tialo, Jawan, and Helong, utilize cogon grass roots as an aphrodisiac herb.¹⁶⁻¹⁷ However, there have been no reported studies regarding the aphrodisiac properties of *I. cylindrica* roots. This study evaluated the aphrodisiac properties of *I. cylindrica* roots in male Wistar rats.

Materials and Methods

Collection and authentication of plant materials

I. cylindrica roots were collected from rice fields in the Subak Mundeh area of Nyambu Village, Kediri-Tabanan District, Bali (8°34'43.7"S 115°08'40.4"E) in July 2022. The plants grew in dry soil and were characterized by their mature stage and brownish-yellow leaves. The roots obtained were identified and authenticated by the Directorate of Scientific Correction Management at the "Eka Karya" Botanical Gardens in Bedugul, Bali (National Research and Innovation Agency) (number of sample 1617-97127-1).

Extraction

The extraction was done at the Integrated Services Laboratory of the Faculty of Agricultural Technology, Universitas Udayana. The maceration method was used to prepare the extract using 96% ethanol (PT. Brataco, Indonesia). Approximately 4 kg of previously washed and air-dried *I. cylindrica* roots were cut into small pieces (1–1.5 cm) and dried in a dehydrator at 40°C–50°C for 24 h. They were blended until a smooth consistency was achieved and passed through a 40-mesh sieve. The powdered roots were then subjected to maceration with 96% ethanol in a ratio of 1:10 (sample: solvent). The maceration process involved stirring the mixture for 15 min at 2-h intervals, for a total maceration time of 48 h. Then, the sample was filtered using ordinary filter paper until the extract no longer dripped. The filtrate was evaporated using an evaporator until no solvent was dripping from the apparatus. The evaporation process was carried out at 40°C, with 100 rpm flask rotation speed and 100 Mbar vacuum pressure. The total amount of extract obtained after the evaporation process was 42 g.

ELISA kit and reagents

Ethinyl estradiol (Ovalumon) and progesterone (Potahormon) were obtained from Wonderindo, Indonesia. Sildenafil citrate was obtained from Viagra 100 mg, manufactured by Pfizer in Indonesia. The ELISA Kit reagent used to measure serum testosterone levels was from BT Lab (Code: EA0023Ra), provided by CV Gamma Scientific Biolab in Malang, Indonesia.

Grouping of experimental animals and administration of extracts

This research protocol was approved by the Ethics Commission Unit of the Faculty of Medicine, Udayana University, with approval number 2416/UN14.2.2.VII.14/LT/2022. A total of 25 male Wistar rats, aged 4–5 months, weighing 200–250 g, and 15 female Wistar rats, aged 4–5 months, weighing 150–200 g, were used in this study. The male rats had at least two previous copulation experiences. The experimental animals were obtained from the Department of Histology, Faculty of Medicine, Universitas Udayana. The animals were housed in cages measuring 46 × 38 × 24 cm, which were maintained in a clean condition. They were provided with access to water and CP551 pellet food. The room was properly ventilated, and the temperature was maintained at 25°C ± 2°C. The light cycle followed a 12-h natural light period and a 12-h dark period. Experimental animals were closely monitored and weighed daily

throughout the treatment period. Male Wistar rats were randomly divided into five groups, including three treatment and two control groups. Each group consisted of five rats. The treatment groups received different doses of the ethanol extract of *I. cylindrica* roots: 100, 200, and 400 mg/kg BW. The positive control group received sildenafil citrate at 5 mg/kg BW, while the negative control group was administered 2 ml distilled water. Since the ethanol extract of *I. cylindrica* roots and sildenafil are not soluble in water, Tween 20 was added to each treatment solution. The distilled water solution given to the negative control group also contained Tween 20. The extracts and drugs were administered orally for 28 days using an orogastric tube.

Rat sexual behavior trial procedure

Before the research was conducted, all experimental animals were acclimatized for one week. To assess the sexual behavior activity of male rats, the preparations and procedures followed the method described by Singh et al.¹⁸ Before the treatment, male rats were trained by exposing them to sexually receptive females once a day for four consecutive days. The female rats needed to be artificially induced into the estrus phase before mating with the male rats because female rats only accept mating when they are in the estrus phase. It was achieved by administering ethinyl estradiol at 100 µg dose per rat (Ovalumon, 0.01 ml) subcutaneously 48 h before pairing and a subcutaneous injection of 1 mg progesterone per rat (Potahormon, 0.01 ml) 4 h before pairing. The acceptance of female rats was confirmed by exposing them to male rats that were not part of the research sample. The most receptive females were then selected and paired with male rats in a one-to-one ratio. The experiments were conducted during the dark phase, approximately from 8:00 p.m. to 4:00 a.m. local time on day 28 after treatment. Before mating, the male and female rats were placed in a glass cage (46 cm × 38 cm × 24 cm) for a 30-minute adaptation period. Thirty minutes after the male rats were given the extract, they were placed in the glass box. Ten minutes later, the female rats in heat were introduced into the cage. The mating process was observed immediately after the female rats were placed in the male rats' cage. The observation lasted for 30 min and was recorded using the Xiaomi Home Security Camera 360° CCTV camera with its infrared feature activated. The parameters evaluated were mounting latency: the time from when the male rat was paired with the female rat until the male rat first mounted the female rat (measured in seconds); intromission latency: the time from when the male rat was paired with the female rat until the male rat first performed intromission (measured in seconds); ejaculatory latency: the time from the first intromission to ejaculation (measured in seconds); postejaculatory mounting interval: the time from the first ejaculation to the next mounting (measured in seconds); mounting frequency: the number of mountings during the 30-min observation period; intromission frequency: the number of intromissions during the 30-min observation period. After the mating process occurred, the cage needed to be cleaned regularly to eliminate the urine odor, as this can significantly affect the subsequent mating process of the rats to be tested.

Blood collection and serum preparation

Blood samples were collected on day 29. Before blood collection, the rats were anesthetized with 10% ketamine at a dose of 50 mg/kg BW and 2% xylazine at a dose of 20 mg/kg BW intramuscularly in their thigh muscles. Blood sampling was collected at the orbital plexus, located at the inner corner of the eye. The blood was then transferred to a sterile tube and centrifuged at 1,200 g for 5 min at room temperature. The serum was collected and stored at –20°C.

Examination of serum testosterone levels

The serum testosterone examination procedure was carried out according to the protocol in the reagent kit from BT Lab (Code: EA0023Ra). Sample, standard, and biotinylated antigen was incubated for 60 minutes at 37°C, aspirated, and washed for 5 times. Then, avidin-HRP was added and incubated for 60 minutes at 37°C. The same procedure was conducted after adding substrate solution A and B. The OD value was analyzed within 10 minutes at 450 nm after adding stop solution.¹⁹

Data analysis

The data are presented as mean \pm SEM and analyzed using SPSS 25 and GraphPad Prims nine. Tests for different means for the five groups used one-way ANOVA + post hoc Tukey HSD for normally distributed data with the same variance and one-way ANOVA Welch + post hoc Dunnett T3 if the variant is different. The data is said to be significantly different if the p-value is <0.05 .

Results and Discussion

Effects of *I. cylindrica* root ethanol extract on sexual behavior

Assessing rat sexual behavior, including mounting (frequency and latency), provides insights into sexual drive and motivation. An increase in mounting frequency and a decrease in mounting latency indicate heightened sexual drive (motivation). The parameters related to intromission (frequency and latency) reflect the rat's erectile ability, while the ejaculation parameter signifies sexual satisfaction. These mounting, intromission, and ejaculation parameters serve as indicators to measure libido, sexual potency, and sexual vigor.²⁰

The results revealed that the mounting latency in all treatment groups (100, 200, and 400 mg/kg BW) and the positive control group (sildenafil, 5 mg/kg BW) were significantly decreased compared with that of the negative control group (aquades) ($^a p < 0.05$). Moreover, the 400 mg/kg BW dose showed an enhancement and significant difference compared with the 200 mg/kg BW dose ($^* p < 0.05$) and the positive control ($p < 0.01$) (Figure 1A). The mounting latency assessment results were closely aligned with those of intromission latency. Figure 1B demonstrates that the intromission latency in all treatment and positive control groups decreased significantly compared with that of the negative control group ($^a p < 0.05$). In the treatment groups, intromission latency exhibited an enhancement and significant difference between the 200 and 400 mg/kg BW doses ($^* p < 0.05$). The mean intromission latency of the 400 mg/kg BW treatment group also significantly differed from that of the positive control group ($^{**} p < 0.01$). Mounting latency and intromission latency did not significantly differ between the 100 and 200 mg/kg BW treatment groups and the positive control group ($^b p > 0.05$). The 200 mg/kg BW group closely resembled the positive control group in terms of mounting latency and intromission latency parameters.

The ejaculatory latency parameter was increased in the treatment group. Statistical analysis demonstrated a significant difference in the average ejaculatory latency time between the 100 and 200 mg/kg BW treatment groups compared with that of the negative control group ($^* p$

< 0.05), as depicted in Figure 2. Furthermore, there was no significant difference in the average ejaculatory latency between the positive control group and the 100 and 200 mg/kg BW treatment groups ($^b p > 0.05$). This suggests that the effect of *I. Cylindrica* root extract at doses of 100 and 200 mg/kg BW had a comparable ejaculatory latency time to sildenafil (5 mg/kg).

The postejaculatory mounting interval parameters were found to be decreased in the treatment groups. Figure 3 presents the results of the Dunnett T3 post hoc test, indicating a significant difference in the average postejaculatory mounting interval time between the negative control group and the treatment groups administered with cogon grass root extract at doses of 100 and 200 mg/kg BW ($p < 0.05$).

Statistical analysis revealed no significant difference in the postejaculatory mounting interval between the positive control and the treatment groups (100 and 200 mg/kg BW, $^a p > 0.05$). This indicates that the administration of *I. cylindrica* root extract at doses of 100 and 200 mg/kg BW resulted in a reduction in postejaculatory mounting interval comparable to that of the positive control group.

Furthermore, the mounting frequency and intromission frequency in the treatment groups increased. As shown in Figure 4, the mounting frequency of the negative control group notably differed from that of the treatment groups at all extract doses ($^a p < 0.05$). Additionally, there was no significant difference in the average mounting frequency between the positive control group and the 100 mg/kg BW treatment group ($^b p > 0.05$). This indicates that the 100 mg/kg BW dose exhibited a mounting frequency that was nearly comparable to that of the positive control group.

The post hoc test using Tukey HSD revealed a significant difference in the mean intromission frequency between the negative control group and all treatment groups ($^a p < 0.05$). Furthermore, the Tukey HSD post hoc test results indicated no significant difference in the mean intromission frequency between the positive control group and the 100 mg/kg BW treatment group ($^b p > 0.05$). These findings suggest that a dose of 100 mg/kg BW has a similar effect on intromission frequency when compared with 5 mg/kg BW sildenafil.

The observed decrease in mounting latency, intromission latency, and postejaculatory mounting interval, along with the increased mounting frequency, suggests heightened arousal and enhanced sexual motivation in the male rats. Additionally, the increased intromission frequency indicates improved erectile function. Therefore, similar results were reported by Ramalan et al.,²¹ who studied the aphrodisiac effect of methanol extract from *Borassus aethiopicum* Mart. in Wistar rats.

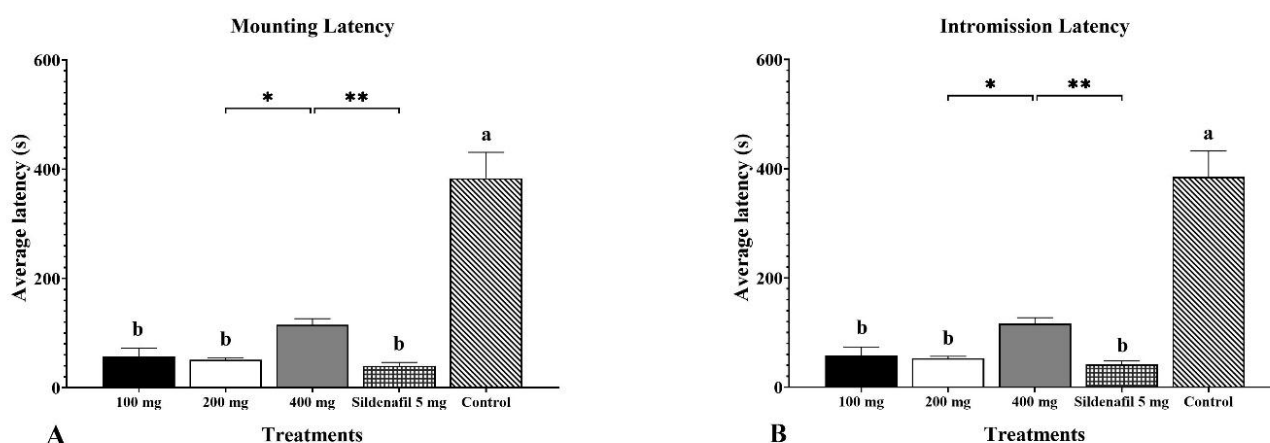


Figure 1: The effect of administering ethanol extract of cogon grass (*Imperata cylindrica*) root on mounting latency [A] and Intromission latency [B]. The graphs represent the results of the Dunnett T3 post hoc test. Graphs labeled with the letter *a* indicate a significant difference compared with graphs not labeled with the letter *a* ($p < 0.05$). The graph labeled with the letter *b* did not show a significant difference from the group labeled with the letter *b* ($p > 0.05$). The data presented are expressed as mean \pm SEM; $n = 5$; $^* p < 0.05$; $^{**} p < 0.01$.

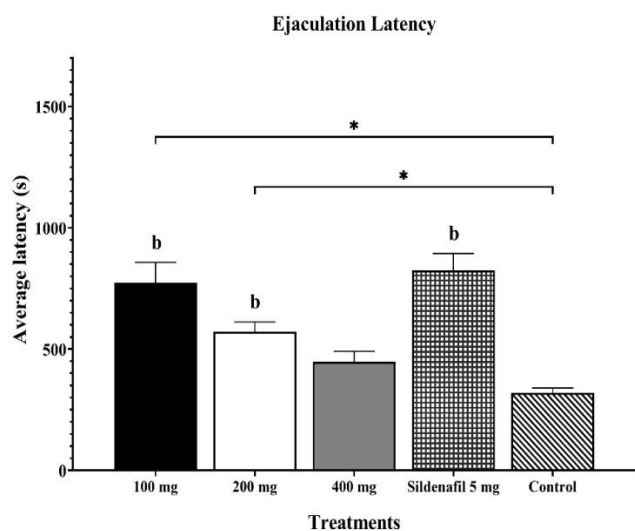


Figure 2: The effect of administering ethanol extract of *Imperata cylindrica* roots on ejaculation latency. Graphs labeled with the letter *b* indicate no significant difference. The data presented represent the mean \pm SEM; $n = 5$; * $p < 0.05$.

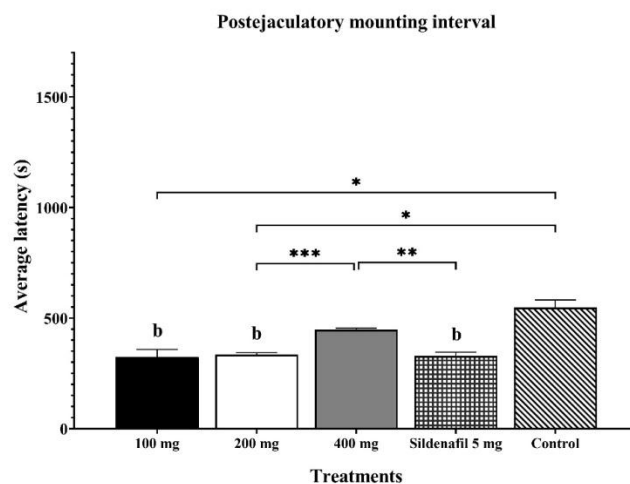


Figure 3. Effect of giving cogon grassroots ethanol extract (*Imperata cylindrica*) on the postejaculatory mounting interval. The graph above is a Dunnett T3 post hoc result. Graphs labeled with the letter *b* are not significantly different. The data presented are the mean \pm SEM; $n = 5$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

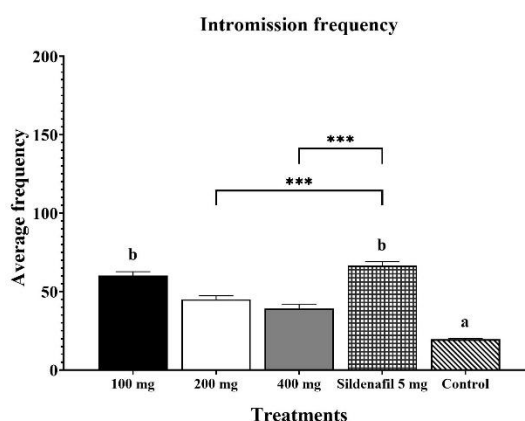
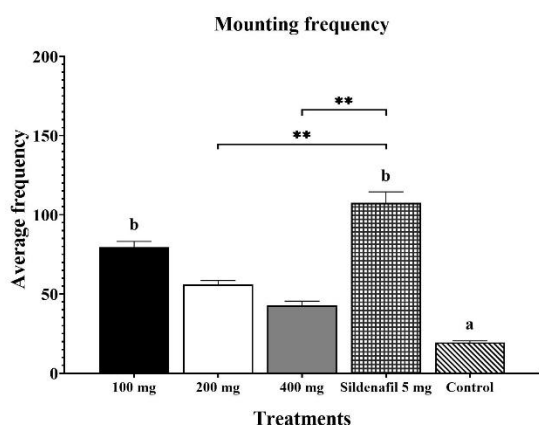


Figure 4: The effect of administering *Imperata cylindrica* root ethanol extract on mounting frequency and intromission frequency. The graph representing mounting frequency is the result of the Dunnett T3 post hoc test, while the graph illustrating intromission frequency is based on the Tukey HSD post hoc test. Graphs marked with the letter *a* indicate a significant difference compared with graphs without the label *a* ($p < 0.05$). Graphs labeled with the letter *b* did not show a significant difference from the group labeled with the same letter ($p > 0.05$). The data presented in the graphs represent the mean \pm SEM; $n = 5$; ** $p < 0.01$; *** $p < 0.001$.

The results showed that the mounting frequency, intromission frequency, and ejaculation frequencies were increased on days 7 and 28, along with an increased of extract doses. Mounting latency and intromission latency were decreased compared with negative control.²¹ These findings are also consistent with other previous studies by Fouche et al.,²² Kenmogne et al.,²³ and Tang et al.²⁴ The prolonged ejaculation latency observed in this study indicates an enhancement of rat sexual function due to the aphrodisiac effects of *I. cylindrica* root extract, as reported by Singh et al.,²⁵ Fouche et al.,²² and Ramalan et al.²¹ Notably, increasing the extract dose to 400 mg/kg BW did not further increase ejaculatory latency or decrease postejaculatory mounting interval, which is in agreement with the findings of Erhabor and Idu.²⁶

Effects of *I. cylindrica* root ethanol extract on serum testosterone levels

Testosterone plays a crucial role in sexual function, as documented in numerous studies. It is responsible for regulating sexual motivation, sex drive, and sexual performance. In men, testosterone is vital for

maintaining erectile function.²⁷ Testosterone exerts its influence on sexual function and response through mechanisms in the brain or periphery²⁸ and is primarily produced by the Leydig cells in the testes.²⁹

Serum testosterone levels were observed to increase in all treatment groups compared with the control groups. Figure 5 shows the statistical test results indicating a significant difference in the mean serum testosterone levels between the negative control group and all treatment groups (**** $p < 0.0001$).

The serum testosterone level decreased slightly with the increased of the doses. The highest levels were observed at a dose of 100 mg/kg BW, whereas the lowest levels were observed at 400 mg/kg BW. Nwokike et al. also reported an increase in serum testosterone levels following the administration of *I. cylindrica* root extract, although their results showed higher testosterone levels with higher extract doses.³⁰ The precise mechanism through which cogon grass (*I. cylindrica*) roots elevate serum testosterone levels remains unclear and warrants further investigation. However, the Tukey HSD post hoc analysis revealed no significant difference in the mean serum

testosterone levels among the treatment groups. This indicates that all doses of *I. cylindrica* root extract administered for 28 days have the potential to increase serum testosterone levels.

Compounds in plants that have aphrodisiac effects generally contain saponins, flavonoids, and alkaloids. Saponin compounds affect androgenic and gonadotrophic activity. Flavonoids have androgenic effects, while alkaloid compounds play a role in increasing cholesterol synthesis in the testes, which is necessary for the synthesis of the hormone testosterone, increasing levels of nitric oxide, and relaxing the smooth muscle of the corpus cavernosum.³¹ Jayalakshmi et al.³² and Khaerunnisa et al.³³ reported the presence of flavonoids as a secondary metabolite found in reed root extract using water or alcohol solvents. Dhianawaty et al.³⁴ reported that from 96 mg of alcoholic extract of the roots of the reeds, the flavonoid content was found to be 1.17%. Based on the results of the studies above, it can be linked that reed roots can act as an aphrodisiac because the extract contains flavonoids, which have an androgenic effect (increases the synthesis of the hormone testosterone). The exact mechanism still requires further research.

This study has certain limitations, particularly concerning the measurement of serum testosterone levels and the assessment of rat sexual behavior. It is recommended that both serum testosterone levels and rat sexual behavior be measured weekly to provide a more comprehensive understanding of the effects of *I. cylindrica* root extract. Additionally, the study did not include measurements of luteinizing hormone and follicle-stimulating hormone levels, which are important hormonal markers in the regulation of sexual function. Future studies could consider including these hormone measurements to gain further insights into the mechanisms underlying the observed effects.

Conclusion

Overall, this study provides evidence that the ethanol extract of *I. cylindrica* roots have potential as an aphrodisiac, aligning with their traditional use in Indonesian ethnic groups as a traditional medicine. Particularly, a dose of 100 mg/kg BW of the extract demonstrated promising results in terms of its aphrodisiac effects. The observed increase in serum testosterone levels suggests that this may be one of the mechanisms through which the extract exerts its aphrodisiac properties. Considering its androgenic effects, further research on cogon grass root extract could be explored for potential applications in hypogonadism and male infertility cases.

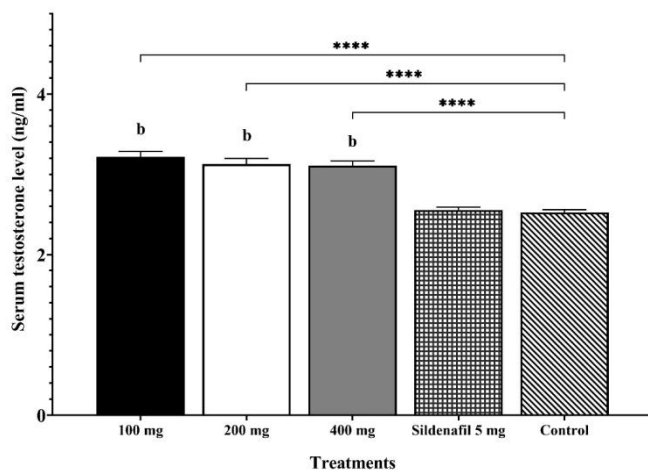


Figure 5: The effect of administering ethanol extract of *Imperata cylindrica* roots on serum testosterone levels, analyzed with Tukey HSD post hoc analysis. Graphs labeled with the letter *b* indicate no significant difference. The unlabeled graphs also show no significant difference ($p > 0.05$). The data presented represents the mean \pm SEM; $n = 5$; **** $p < 0.0001$.

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.

Acknowledgments

The authors would like to thank the Udayana University Research and Community Service Institute (LPPM) for providing grants for this research.

References

- Anderson D, Laforge J, Ross MM, Vanlangendonck R, Hasoon J, Viswanath O, Kaye AD, Urits I. Male sexual dysfunction. *Health Psychol Res.* 2022; 10(3): 37533.
- Irfan M, Hussain NHN, Noor NM, Mohamed M, Sidi H, Ismail SB. Epidemiology of male sexual dysfunction in Asian and European regions: A systematic review. *Am J Mens Health.* 2020; 14(4): 1-40.
- Zhang H, Yip AW, Fan S, Yip PS. Sexual dysfunction among Chinese married men aged 30-60 years: A population-based study in Hong Kong. *Urology.* 2013; 81(2): 334-339.
- Birowo P, Deswanto IA, Rasyid N. Epidemiology of erectile dysfunction: A cross-sectional web-based survey conducted in an Indonesian National Referral Hospital. *F1000Res.* 2019; 8: 1-12.
- Lotti F, Maggi M. Sexual dysfunction and male infertility. *Nat Rev Urol.* 2018; 15(5): 287-307.
- Cuenca AIC, Sampietro-Cresp A, Virseda-Chamorr M, Martín-Espinosa N. Psychological impact and sexual dysfunction in men with and without spinal cord injury. *J Sex Med.* 2015; 12(2): 436-444.
- McBride JA, III CCC, Coward RM. Testosterone deficiency in the aging male. *Ther Adv Urol.* 2016; 8: 47-60.
- Ahmed K, Hatzimouratidis K, Muneer A. Male sexual dysfunction and hypogonadism guidelines for the aging male. *Eur Urol Focus.* 2017; 3(4-5): 514-516.
- Kovac JR, Rajanahally S, Smith RP, Coward RM, Lamb DJ, Lipshultz LI. Patient satisfaction with testosterone replacement therapies: The reasons behind the choices. *J Sex Med.* 2014; 11(2): 553-562.
- Avasthi A, Grover S, Sathyanarayana-Rao TS. Clinical practice guidelines for management of sexual dysfunction. *Indian J Psychiatry.* 2017; 59(Suppl 1): S91-S115.
- Barroso F, Ribeiro JC, Miranda EP. Phosphodiesterase type 5 inhibitors and visual side effects: A narrative review. *J Ophthalmic Vis Res.* 2021; 16(2): 248-259.
- Corona G, Vignozzi L, Sforza A, Maggi M. Risks and benefits of late-onset hypogonadism treatment: An expert opinion. *World J Mens Health.* 2013; 31(2): 103-125.
- da Cruz AC, Guerra NG, de Souza KEBP, de Castro Eleutério I, da Silva LC, Otoni EG, Alves MRA, Regis WCB. The action of herbal medicine on the libido: Aspects of nutritional intervention in increasing sexual desire. *Nutrire.* 2017; 42(1): 29.
- Sin VJ-E, Anand GS, Koh H-L. Botanical medicine and natural products used for erectile dysfunction. *Sex Med Rev.* 2021; 9(4): 568-592.
- Kotta S, Ansari SH, Ali J. Exploring scientifically proven herbal aphrodisiacs. *Pharmacogn Rev.* 2013; 7(13): 1-10.
- Haryanti S, Widodo H, Fauzi F. Kajian tumbuhan obat yang banyak digunakan untuk aprodisiaka oleh beberapa etnis Indonesia [Study of medicinal plants that are widely used

- for aphrodisiacs by several Indonesian ethnic groups]. Media Litbangkes. 2019; 29(1): 51-64.
17. Fauzi F, Widodo H. Short communication: Aphrodisiac plants used by Dayak ethnic in Central Kalimantan province, Indonesia. Biodiversitas J Biol Div. 2019; 20(7): 1859-1865.
 18. Singh R, Ali A, Jeyabalan G, Semwal A, Jaikishan. An overview of the current methodologies used for evaluation of aphrodisiac agents. J Acute Dis. 2013; 2(2): 85-91.
 19. Lab B. Protocol booklet rat testosterone elisa kit cat.No: Ea0023ra 2023. [Online]. 2023. [cited 2023 Aug 23]. Available from: https://www.bt-laboratory.com/index.php/Shop/Index/productShijiheDetail/p_id/3475.html.
 20. Heijkoop R, Huijgens PT, Snoeren EMS. Assessment of sexual behavior in rats: The potentials and pitfalls. Behav Brain Res. 2018; 352: 70-80.
 21. Ramalan MA, Shuaibu AB, Abdussalam US, Yaro AH. Aphrodisiac effect of methanol hypocotyls extracts of *Borassus aethiopum Mart.* in male Wistar rats. Trop J Nat Prod Res. 2021; 5(10): 1852-1858.
 22. Fouche G, Afolayan AJ, Wintola OA, Khorombi TE, Senabe J. Effect of the aqueous extract of the aerial parts of *Monsonia angustifolia* E. Mey. Ex A. Rich., on the sexual behavior of male Wistar rats. BMC Complement Altern Med. 2015; 15: 343.
 23. Kenmogne H, Koloko B, Hambe C, Domkam J, Ngaha Njila M, Bend E, Oundoum Oundoum P, Massoma Lembè D, Dimo T. Effects of aqueous root extract of *Carpolobia alba* G. Don on sexual behavior in adult male rats. Andrologia. 2016; 48(8): 908-914.
 24. Tang X, Olatunji OJ, Zhou Y, Hou X. In vitro and in vivo aphrodisiac properties of the seed extract from *Allium tuberosum* on corpus cavernosum smooth muscle relaxation and sexual behavior parameters in male Wistar rats. BMC Complement Altern Med. 2017; 17: 510.
 25. Singh S, Nair V Fau - Gupta YK, Gupta YK. Evaluation of the aphrodisiac activity of *Tribulus terrestris* Linn. in sexually sluggish male albino rats. J Pharmacol Pharmacother. 2012; 3(1): 43-47
 26. Erhabor JO, Idu M. 2017. Aphrodisiac potentials of the ethanol extract of *Aloe barbadensis* Mill. root in male Wistar rats. BMC Complement Altern Med. 2017; 17: 360-370.
 27. Bianchi N, Prontera O, Dicuio M, Concetti S, Sforza A, Corona G. Male sex hormones in andrology today. In: Bettocchi C, Busetto GM, Carrieri G, Cormio L (Eds.). Practical clinical andrology. Italy: Springer; 2023. 251-261 p.
 28. Corona G, Torres LO, Maggi M. Testosterone therapy: What we have learned from trials. J Sex Med. 2020; 17(3): 447-460.
 29. Zirkin BR, Papadopoulos V. Leydig cells: Formation, function, and regulation. Biol Reprod. 2018; 99(1): 101-111.
 30. Nwokike MO, Ghasi SI, Ogbonna AO, Anusiem CA. The effect of *Imperata cylindrica* root aqueous extracts on serum testosterone levels of hyperglycemic rats. J Pharma Pharma Sci. 2020; 4(1): 187.
 31. da Cruz AC, Guerra NG, de Souza KEBP, de Castro Eleutério I, da Silva LC, Otoni EG, Alves MRA, Regis WCB. The action of herbal medicine on the libido: Aspects of nutritional intervention in increasing sexual desire. Nutrire. 2017; 42(1):42-49.
 32. Jayalakshmi S, Patra A, Lal VK, Ghosh AK. Pharmacognostical standardization of roots of *Imperata cylindrica* Linn (Poaceae). J Pharm Sci Res. 2010; 2(8):472-6.
 33. Khaerunnisa S, Aminah NS, Kristanti AN, Kuswarini S, Wungu CDK, Soetjipto S, Suhartati S. Isolation and identification of a flavonoid compound and *in vivo* lipid-lowering properties of *Imperata cylindrica*. Biomed Rep. 2020;13(5):1-8.
 34. Dhianawaty D, Ruslin R, Syamsunarno MRAA, Haminah H. Kandungan total flavonoid dari ekstrak metanol akar *Imperata cylindrical* (L) Beauv. (alang-alang) [Total flavonoid content of methanol extract of *Imperata cylindrical* (L) Beauv roots]. Talenta Conf Ser: TM. 2018; 1(3): 25-28.