

ISSN: 2320 – 7051

International Journal of Pure & Applied Bioscience (IJPAB): Bimonthly Publishing

Available online at www.ijpab.com

Journal Metrics

Abbreviation: *Int. J. Pure App. Biosci.*

CODEN: IJPAB

Language: English

ISSN: 2320 – 7051

Start Year: 2013

Publication: 6 issue pre year

DOI: 10.18782/2320-7051

Published Articles: 634

International Citation Report (ICR)

Impact factor:

Global Impact Factor: 0.654 (2015)

ISI Impact Factor: 1.106 (2014)

SJIF Impact Factor: 5.358 (2015)



IJPAB is Cross^{ref} enabled Journals

2016 Volum 4, issue 3



Publisher

This Journal is published by Vital Biotech, India



[Home](#) >> [Editorial Board](#)

Editorial, Advisory Board Member & Reviewer

Editor-in-Chief

Dr. Jitendra Mehta
Head and Scientist, Dept. of Biotechnology & Microbiology, Vital Biotech,
Faculty of Biology, Lzebra Institute, Career Point University, Kota, Rajasthan, India
E mail: editor@ijpab.com [\[Click Here\]](#)

Executive Editor

Dr. Neerja Srivastava
Senior Lecturer, Department of Botany
Govt. P.G. College, Kota, Rajasthan, India
E mail: neerjasrivastava143@gmail.com [\[Click Here\]](#)

Dr. Nagasamy Venkatesh
Assistant Professor, Dept. of Pharmaceutics
Jss College Of Pharmacy, Ooty-643 001. Tamil Nadu, India
E mail: nagasamyvenkatesh@rediffmail.com [\[Click Here\]](#)

Prof. (Dr.) A.N. Pathak, Ph.D. (Biochem. Eng.–IIT Delhi), Post. Doc. Germany & USA
Dean Research, Amity University Rajasthan, Jaipur, India
Coordinator – Amity Academic Staff College (AASC), AUR, Jaipur
Ex – Senior Manager (Pfizer Corporation, U.S.A.)
E mail: anpathak2004@gmail.com [\[Click Here\]](#)

Dr. Maulin P. Shah
Chief Scientist & Head, Industrial Waste Water Research Laboratory
Division of Applied & Environmental Microbiology
Enviro Technology Limited Ankleshwar-393002 Gujarat, India
E mail: shahmp@uniphos.com [\[Click Here\]](#)

Dr. Sanjay Shamrao Nanware
Assistant Professor in Zoology, Department of Zoology
Shri Sharda Bhavan Edu. Society's, Yeshwant Mahavidyalaya, Nanded, (M.S.) India
E mail: snanware@rediffmail.com [\[Click Here\]](#)

Dr. Girish K. Goswami
Professor and Campus Director
CU Shah Institute of Life Sci., C.U. Shah University, Surendranagra, Gujarat, India
E mail: girishkgoswami@gmail.com [\[Click Here\]](#)

Dr. Krishnendra Singh Nama
Sr. Lecturer, Deptt. of Botany, M.B. PG College
Career Point University, Kota, Rajasthan, India
E mail: namasahib@gmail.com [\[Click Here\]](#)

Dr. Santanu Sarma
Ass. Professor, Dept. of Zoology
Bholanath College, Dhubri-783324, Assam, India
E mail: dr.santanusarma111@gmail.com [\[Click Here\]](#)

Dr. Priyanka Sharma
Young scientist, Gold medalist, University of Kota, Rajasthan, India
Conservation Pteridologist at Cape Town, South Africa
E mail: priyankasharma17aug@gmail.com [\[Click Here\]](#)

Dr. Manjul Mishra
Head and Lecturer, Dept. of Chemistry
M. D. Mission College, Keshavpura, Kota, Rajasthan, India
E mail: manjulmishra7@gmail.com [\[Click Here\]](#)

Dr. Arshia Parveen
Assistant Professor, Department of Chemistry
B. Raghunath Arts, Comm. and Science College, Parbhani (M.S.) India
E mail: arshiairfanmalik@gmail.com [\[Click Here\]](#)

Dr. Tahira Begum
Lecturer (Botany) Govt College, Ajmer (Raj) 305001
E mail: tahira786333@gmail.com [\[Click Here\]](#)

Dr. Shivali Kharoliwal
Head and Lecturer, Dept. of Botany
Lzebra Girls College, Dadabari, Kota, Rajasthan, India
E mail: kharoliwalshivali76@gmail.com [\[Click Here\]](#)

Associate Editor (Life Sciences)

Dr. Anju Verma
Scientist & Postdoctoral Research Associate, 315 Bond Life Sciences Center
University of Missouri, USA, 1201 Rollins Plaza., Columbia, MO 65211
E mail: vermaan@missouri.edu [\[Click Here\]](#)

Associate Editor (Healthcare)

Dr. Afrozul Haq
Principal Scientist, R & D Division, VPS Healthcare, Abu Dhabi, UAE
E mail: drafrozulhaq@vpshealth.com [\[Click Here\]](#)

Associate Editor (Pathology & Immunology)

Dr. Sachin Kumar Gupta
Post-doctorate Associate, Department of Pathology & Immunology
Baylor College of Medicine, One Baylor Plaza, Houston, TX, 77030, USA
E mail: sachinkgupta1708@gmail.com [\[Click Here\]](#)

Dr. Ashok Kumar VERMA
Asst. Professor, Dept. of Zoology
Govt. PG College Saidabad-Allahabad (U.P) 221508 India
E mail: akv.apexz@gmail.com [\[Click Here\]](#)

Dr. Ved Kumar Mishra
Assistant Professor, Dept. of Biotechnology
Ashoka Institute of Technology and Management, Pahadiya, Sarnath, Varanasi
Affiliated by- Dr. A. P. J. Abdul Kalam Technical University, Lucknow, U. P.-India
E mail: ved.m45@gmail.com [\[Click Here\]](#)

Dr. M.K. Meena
Assistant Professor (Crop Physiology)
University of Agricultural Sciences, Raichur, Karnataka, India
E mail: meenam4565@gmail.com [\[Click Here\]](#)

Dr. Nayan Roy
Assistant Professor Dept. of Zoology
M. U. C. Women's College, Burdwan-713104 West Bengal, India
E mail: nayan909@gmail.com [\[Click Here\]](#)

Dr. Kiran Choudhary
Sr. Lecturer, Deptt. of Botany, M.B. PG College, Kota, Rajasthan, India
E mail: choudharykiran01@gmail.com [\[Click Here\]](#)

Dr. Dhanraj Balbhim Bhure
Assistant Professor in Zoology, Department of Zoology
Shri Sharda Bhavan Edu. Society's, Yeshwant Mahavidyalaya, Nanded, (M.S.) India
E mail: drajbhure82@gmail.com [\[Click Here\]](#)

Dr. Monjit Saikia
Associate Professor & HOD, Deptt, of Botany, Hojai College,
Hojai, Nagaon, Assam, India
E mail: mondion37@yahoo.co.in [\[Click Here\]](#)

Dr. Mathews Plamoottil
HOD & Assistant Professor in Zoology, Department of Zoology
Baby John Memorial Govt. College, Chavara, Kollam, Kerala, India
E mail: mathewsplamoottil@gmail.com [\[Click Here\]](#)

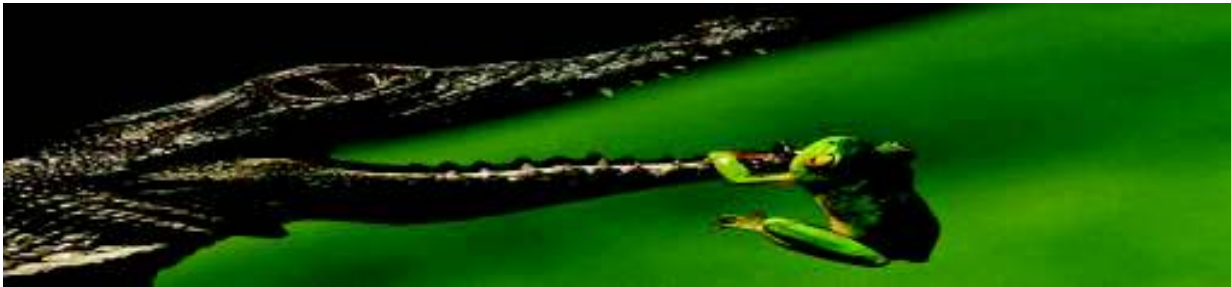
Dr. Jeeva. S
Head and Ass. Professor, Dept. of Microbiology
Udaya College of Arts and Science, Vellamodi, Tamilnadu, India
E mail: jeevarajaseker@gmail.com [\[Click Here\]](#)

Dr. Subha Ganguly
Associate Professor and HEAD, Dept. of Veterinary Microbiology,
Arawali Veterinary College N.H. - 52 Jaipur Road, V.P.O. Bajor,
Dist. Sikar, Pin - 332001, Rajasthan, India
E mail: ganguly38@gmail.com [\[Click Here\]](#)

Dr. Madhumati Bora
Head (Biotech, Genetics & Bioinformatics) N.V. Patel College of
Pure & Applied Sciences, Vallabh Vidyangar, Anand - 386120, Gujarat, India
E mail: drmadhumatibora@gmail.com [\[Click Here\]](#)

[Home](#) | [About us](#) | [Instructions to Authors](#) | [Archives](#) | [Contact Us](#) | [Download](#)





[Home](#) >> [Archives](#)

Archives - 2016 Volume 4, issue 3

[March - April 2016 Volume 4, Issue 3 - Journal Cover Page](#) [Download pdf](#)

1. [Estrous Cycle of Mice \(*Mus Musculus* L.\) Exposed by Repeated Gamma Rays Radiation](#)

Ni Wayan Sudatri, Dwi Ariani Yulihastuti, Ida Bagus Made Suaskara and Ni Made Suartini

Page No: 1-4 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2272>

Laboratory of Animal Physiology, Faculty of Mathematic and Natural Sciences, Udayana University, Bali, Indonesia

[Download](#) : 4

2. [Effectiveness of neonicotinoids and organophosphate in the control of aphid and enhancement of pod formation in mustard crop in India](#)

Moses I. Olotu

Page No: 5-11 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2277>

Department of Life Sciences, Mkwawa University College of Education (MUCE), P.O. Box 2513 Iringa, Tanzania

[Download](#) : 4

3. [The investigation of some bacteria contaminations paper currency circulation in the Iraqi domestic Market in the city of Samawah by using CHROM agar](#)

Maytham Abas makki and Nuha Muhammed Mousa

Page No: 12-15 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2289>

College of Science, Al-Muthanna University, Iraq

[Download](#) : 5

4. [Embryo-Toxicity and Teratogenicity of *Derris elliptica* Leaf Extract on Zebra Fish \(*Danio rerio*\) Embryos](#)

Josephine Joy V. Tolentino and Jerwin R. Undan

Page No: 16-20 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2293>

Department of Biological Sciences, College of Arts and Sciences, Central Luzon State University, Science City of Muñoz, Nueva Ecija, 3120 Philippines

[Download](#) : 4

5. [Antioxidant, Anticancer Cell Lines and Physicochemical Evaluation of Cobra Oil](#)

Suchitra Khunsap, Taksa Vesaratchapong, Panithi Laongbao, Lawan Chanhome, Supraee Buranapraditkun, Narumo Pakmanee1 and Supatsorn Boonchang

Page No: 21-27 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2296>

Queen Saovabha Memorial Institute, Thai Red Cross Society, Bangkok 10330, Thailand

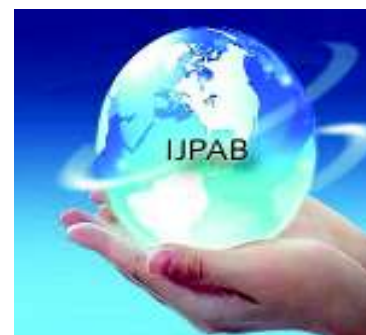
[Download](#) : 3

6. [Plant Species Diversity in Western Tanzania: Comparison between Frequently Burnt and Fire Suppressed Forests](#)

Nyatwere D. Mganga and Herbert V.M. Lyaruu

Page No: 28-44 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2306>



Department of Life Sciences, Mkwawa University College of Education (A Constituent College of the University of Dar es Salaam), P. O. Box 2513, Iringa, Tanzania

[Download : 5](#)

7. [Effects of adding cladode and epidermis extracts of *Opuntia ficus-indica* and *Opuntia atropes* to aerobic mesophilic bacteria and total coliforms in bovine raw milk](#)

Lauro Antonio Delgado, Rosa Elena Pérez, Rafael Roman, Pedro Antonio Garcia, Juvenal Esquivel, and Ruy Ortiz

Page No: 45-55 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2302>

Facultad de Agrobiología "Presidente Juárez"- Universidad Michoacana de San Nicolás de Hidalgo. Paseo Lázaro Cárdenas-Berlín Col. Viveros. Uruapan Michoacán, México

[Download : 2](#)

8. [Influence of Geographical Location on the Antioxidant Activity of Green Tea](#)

Rasha Saad, Fadli Asmani, Poornima, Jiyauddin Khan, Mohammed Kaleemullah, Samer Al-dahlli, Hamid Kazi and Brian Teo

Page No: 56-63 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2315>

College of Pharmacy, King Saud bin Abdulaziz University for Health Sciences Ministry of National Guard Health Affairs, Riyadh, Kingdom of Saudi Arabia

[Download : 2](#)

9. [Influence of Some Plant Extracts on Physiological Traits of French Beans \(*Phaseolus vulgaris* L.\) Infected with Rust \(*Uromyces appendiculatus*\)](#)

Menge Dominic¹, Makobe M., Monda E.O. and Okemo .P.O

Page No: 64-72 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2307>

Department of Plant and Microbial Sciences, School of Pure and Applied Sciences, Kenyatta University, Nairobi Kenya

[Download : 1](#)

10. [Acute Oral Rat Toxicity Study of Multi-herbal formulation \(ECD0058\)](#)

Rohan Thomas and P. G. Kale

Page No: 73-79 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2317>

Department of Zoology, Hindi Vidya Prachar Samiti's, Ramniranjan Jhunjhunwala College, Ghatkopar (West), Mumbai 400 086

[Download : 3](#)

11. [Biocontrol Activity of *Bacillus subtilis* Isolated from Cow Dung Against Plant Pathogenic Fungi](#)

R. Mangalanayaki and T. Thamizhmarai

Page No: 80-86 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2280>

PG and Research Department of Microbiology, Sengamala Thayaar Educational Trust Women's College, Sundarakkottai, Mannargudi-614 001, Tamil Nadu, India

[Download : 3](#)

12. [Seasonal Incidence of Fruit Borers with Special Reference to Melon Fruit Fly, *Bactrocera cucurbitae* \(Coquillett\) on Bitter Gourd *Momordica charantia* L.\)](#)

Sunil, Tippaiah, M and Jayaram, C. S.

Page No: 87-92 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2313>

Department of Agricultural Entomology, UAS, GKVK, Bengaluru, 560065, India

[Download : 6](#)

13. [Plants in Treating Skin diseases from Toranmal Plateau, Nandurbar district, Maharashtra, India](#)

V.V. Bankar and P. P. Sharma

Page No: 93-96 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2281>

Research Center in Botany, Shri. Muktnand College, Gangapur, Aurangabad, India

[Download : 3](#)

14. [In Vitro and In Vivo Induction, and Characterization of Toxins Isolated from *Beauveria bassiana*](#)

A.G. Vikhe, N.S.Dale, R.B. Umbarkar, G.B. Labade, A.R.Savant, and A.A. Walunj

Page No: 97-103 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2303>

Department of Agril. Entomology, College of Agriculture and Agril. Biotechnology, LONI-413736 Tal- Rahata, Dist-Ahmednagar, Maharashtra India

Download : 5

15. [Analysis of Fish Oil as Potential Oxidative Stress Inhibitor in C57BL/6 Mice](#)

Samina Bashir, Yadhu Sharma and Farah Khan

Page No: 104-111 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2312>

Department of Biochemistry, Hamdard University, New Delhi, INDIA

Download : 3

16. [In vitro Efficacy of Different Chemicals, Botanicals and Bioagent Against *Xanthomonas axonopodis* pv. *punicae*](#)

Suresh Haribhau Antre, Swaranjali Kishor Gadhe, Prerana Bhaskar Abhang and Rishikesh Haribhau Autade

Page No: 112-118 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2310>

Department of Biochemistry and Molecular Biology, College of Agricultural Biotechnology, Loni, ITI Campus, Chandrapur Road, Tal. - Rahata, Dist. - Ahmednagar, Pin - 413736, Maharashtra, India

Download : 4

17. [Comparative Study of Water Volume for Zooplankton Analysis in the Kangsabati Reservoir, West Bengal, India](#)

Bera Amalesh, Patra B.C., Sar U.K. and Bhattacharya M. and Dutta, T.K.

Page No: 119-129 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2282>

Aquaculture Research Unit, Department of Zoology, Vidyasagar University, Midnapore, West Bengal, India

Download : 6

18. [Isolation and Purification of Cuticle Degrading Extra Cellular Proteases from Entomopathogenic Fungal Species of *Beauveria bassiana*](#)

A.G. Vikhe, N.S. Dale, R.B. Umbarkar, G.B. Labade, A.R. Savant, and A.A. Walunj

Page No: 130-135 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2304>

Department of Agril. Entomology, College of Agriculture and Agril. Biotechnology, LONI-413736 Tal- Rahata, Dist-Ahmednagar, Maharashtra India

Download : 5

19. [Enzymatic Responses to Pesticide Chlorpyrifos Exposures in Kidney of Fish *Gambusia affinis*](#)

Neelam Sharma, Sudha Summarwar and Jyoutsna Pandey

Page No: 136-143 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2291>

Department of Zoology, Agrawal Girls College, Gangapur City, (S.W.M.) Rajasthan, India

Download : 10

20. [Breeding Performance of Rainbow Trout, *Oncorhynchus mykiss* \(Walbaum\), the Raceways of Kathmandu, Nepal](#)

Rakesh Prasad Bhagat and Sudip Barat

Page No: 144-153 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2285>

Department of Zoology, Tri-Chandra Multiple Campus, Tribhuvan University, Kathmandu- 44600, Nepal

Download : 4

21. [The Frequency of *Pseudomonas aeruginosa* Clinical Isolates in a Tertiary Care Hospital](#)

M. Anitha, D.M. Monisha, A. Mohamed Sulthan, K. Pratikshia and S.R. Swathy

Page No: 154-159 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2301>

Department of Microbiology, Shri Sathya Sai Medical College & Research Institute, Thiruporur, Sri Balaji Vidyapeeth University, Tamil Nadu, India

Download : 3

22. [Studies on Molecular Variability Among *Xanthomonas axonopodis* pv. *punicae* Isolates Collected from Different Locations](#)

Swaranjali Kishor Gadhe, Suresh Haribhau Antre, Bhausaheb Babanrao Ghorpade, Rishikesh Haribhau Autade and Rushil Ramesh Mandlik

Page No: 160-166 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2311>

Department of Biochemistry and Molecular Biology, College of Agricultural Biotechnology, Loni, ITI Campus, Chandrapur Road, Tal. - Rahata, Dist- Ahmednagar 413736, (M.S.), India

Download : 4

23. [Comparison of Nutritional Quality of Lacto-Vegetarian and Non-Vegetarian Diets of Diabetic Patients](#)

Bijal Vora and Madhavi Sathe

Page No: 167-171 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2297>

Department of Clinical Nutrition and Dietetics, Dr. BMN College of Home Science, 338, R A Kidwai Road, Matunga, Mumbai, India

Download : 3

24. [Bacteriological Profile of Diabetic Foot Infected Patients and their Susceptibility Pattern](#)

P.S. Gangania and V.A. Singh

Page No: 172-178 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2305>

Research Fellow (Santosh Medical College & University, Delhi NCR), India

Download : 2

25. [Effect of plant chemical Azadirachtin against pupae of *Spodoptera litura*](#)

Sudha Summarwar and Jyotsana Pandey

Page No: 179-181 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2287>

Research Fellow (Santosh Medical College & University, Delhi NCR), India

Download : 9

26. [Less-known Uses of some Exotic Plants from Ahmednagar District, Maharashtra: Part –I \(A-D\)](#)

S.S. Medakkar and P.P. Sharma

Page No: 182-187 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2308>

Shri. Muktanand College, Gangapur, Aurangabad, Maharashtra, India

Download : 4

27. [Behavioral Changes in *Clarias batrachus* Exposed to Lead Nitrate](#)

Manju Mahurpawar

Page No: 188-192 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2292>

Assistant Professor of Zoology, Govt P.G. College, Parasia (Chhindwara) M.P. India

Download : 2

28. [Catharanthus roses interaction with development stages of *Spodoptera litura*](#)

Sudha Summarwar and Jyotsana Pandey

Page No: 193-196 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2288>

Department of Zoology, S.D. Government college Beawar, M.D.S University Ajmer (Rajasthan) India

Download : 5

29. [Fate of Nucleic Acids in the Tissues of *Cyprinus carpio* under the Toxicity of Heavy Metals](#)

A. Paritha Bhanu

Page No: 197-200 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2295>

P.G. and Research Department of Zoology, ChikkaiahNaicker College, Erode-638004, Tamilnadu, India

Download : 2

30. [Multiple Shoot and Aerial Roots Induced from Various Explants of *P. tetragonolobus* L. \(Winged Bean\)](#)

D.S.R. Naik, T.N. Swamy and A. Seetaram Naik

Page No: 201-205 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2318>

Department of Botany, Kakatiya University, Warangal, Telangana State, India

Download : 2

31. [Cropping Systems Effects on Sustainable Maize Crop \(*Zea mays* L.\) Production on Depleted Tropical Soil](#)

Ayi K. Adden, Gbénonchi Mawussi, Jean M. Sogbedji, Komla Sanda and Kouami Kokou

Page No: 206-215 [Download pdf](#)

doi: <http://dx.doi.org/10.18782/2320-7051.2225>

Institut de Conseil et d'Appui Technique (ICAT), BP : 86 Kpalimé, Togo

Download : 0

[Home](#) | [About us](#) | [Instructions to Authors](#) | [Archives](#) | [Contact Us](#) | [Download](#)





Estrous Cycle of Mice (*Mus Musculus L.*) Exposed by Repeated Gamma Rays Radiation

Ni Wayan Sudatri^{1*}, Dwi Ariani Yulihastuti¹, Ida Bagus Made Suaskara¹ and Ni Made Suartini²

¹Laboratory of Animal Physiology, ²Laboratory of Zoology

Faculty of Mathematic and Natural Sciences, Udayana University, Bali, Indonesia

*Corresponding Author E-mail: sudatri_wayan@yahoo.com

Received: 18.04.2016 | Revised: 26.04.2016 | Accepted: 28.04.2016

ABSTRACT

*This study aims to determine the effect of a repeated gamma radiation on the estrous cycle in mice (*Mus musculus L.*). This research used a completely randomized design (CRD) of gamma ray treatments with a dose of 2 gray (2 gy) i.e. P0 (control), P1 (dose of 1 x 2 gray), P2 (dose of 2 x 2 gray), and P3 (dose of 3 x 2 gray). Estrous cycle was observed on the vaginal swabs with topical method. Parameter measured was estrous cycle length (days). The ANOVA test results of female mice (*Mus musculus L.*) estrous cycle exposed to repeated gamma radiation showed a significant difference ($P = 0.002$). After followed by Duncans test, there were no significant differences between control and treated mice P1 and P2, however, there was significant difference of the P3 treatment (treatment with a dose of gamma radiation 3x 2 gy). Estrous cycle becomes longer in mice (*Mus musculus L.*) treated with repeated gamma radiation.*

Keywords: estrous cycle, radiation, gamma, *Mus musculus L.*

INTRODUCTION

The gamma rays have been used in medicine, industry, hydrology, food preservation and other fields. These rays belong to the ionizing radiation with high penetrating power as well as x-rays. Ionizing radiation is a radiation that the rays will ionise the materials in its path¹. In the medical field, especially nuclear medicine, radioactive preparations which emits gamma radiation were used to diagnose diseases and cancer therapy. With the technique of this radioactive therapy, the life expectancy of patients suffering from cancer was increased². However, everything that has a positive side,

there is also a negative side effect. Nor has the gamma rays, in addition to give a positive benefit, their negative effects on health were also often discussed. Therefore these rays belong to the ionizing radiation, the rays will ionise the materials in its path, including biological materials such as cells. During the therapy, not only cancer cells were killed, but also healthy cells could die or damaged. If the cells did not die immediately, but the nucleus has been changed, most likely within a certain time, it will be changed to a new cancer cells³.

Cite this article: Sudatri, N.W., Yulihastuti, D.A., Suaskara, I.B.M. and Suartini, N.M., Estrous Cycle of Mice (*Mus Musculus L.*) Exposed by Repeated Gamma Rays Radiation, *Int. J. Pure App. Biosci.* 4(3): 1-4 (2016). doi: <http://dx.doi.org/10.18782/2320-7051.2272>

Cells and tissues have different sensitivities to the effects of radiation. Highly sensitive cells to radiation exposure, commonly are actively dividing cells i.e. blood cells, embryonic cells and cells of the gonads (ovaries and testes). The repeated x-ray radiation significantly affect the quality of sperm in mice exposed to X-ray radiation⁴. Likewise, the research of Suharjo⁵, showed male mice that were irradiated with X-ray radiation dose of 200 rads, had a decrease number and diameter of seminiferous tubules of the testes. Weight and testes of male rats irradiated with a dose of 2 to 5 gray were also decreased⁶. The research of Zhang *et al.*⁷ showed that human sperm motility in acrosomal reaction given the high radiation 16, 32, and 64 gray combined with ion 16O + 6 experienced a sharp decline. The purpose of this study was to determine the effect of repeated gamma radiation to the length of the estrous cycle in mice (*Mus musculus* L.).

MATERIALS AND METHODS

This research used dissecting sets, hand counters, scales, paraffin, measuring cups, bowls, dishes, pipettes, glass slide and cover glass, light and stereo microscopes, Radio Gamma equipment (Stabilipan artificial Siemens) at Radiology Unit, Sanglah Hospital. The materials used in this study were 0.9% NaCl, Geimsa 2% in distilled water, Eosin, Hematoxylin, 10% Neutral Buffer Formalin, absolute alcohol, 70% alcohol and xylol. Experimental animals used in this study were 40 female mice (*Mus musculus* L.) strains Switzerland, aged 3 months, body weight 25-30 grams, fed standardized pellets for chicken and water ad libitum.

This research used a Completely Randomized Design (CRD) i.e. 30 irradiated female mice and 10 female mice as controls. The first group of 10 animals were irradiated with gamma rays in a dose of 1 x 2 gray, the second

group of 10 animals were irradiated with gamma rays in a dose of 2 x 2 gray once a week for two weeks, and the third group of 10 animals were irradiated with gamma rays in a dose of 3 x 2 gray once a week for three weeks. Radiation treatments performed with gamma rays at the Radiology Unit of Sanglah Hospital.

After each treatment according to the experimental design, vaginal smear preparations with topical methods were made to observe the estrous cycle of irradiated female mice. Vaginal smears made by inserting the tip of a cotton bud dipped in a solution of 0.9% NaCl solution, twisted around in the vagina then smeared on a glass object that have been etched with 0.9% NaCl. The object glass then fixed in 70% alcohol for 5 minutes then stained with Giemsa for a 10 minutes. The slide then washed with water and wind-dried. Vaginal smear slides were observed under a microscope with a magnification of 100x and photographed by optilab camera.

If a female mice is in an estrus phase, 75% of her superficial cells of vaginal epithelial would be found in cornification form and there were no leucocyte cells⁸. The length between two estrous phases was calculated by observing the vaginal swabs of two cycles after the appropriate radiation dose trial.

Data processing

Quantitative data processed statistically by One Way ANOVA using SPSS program version 22. If there is a significant difference, it will be further analyze with Duncan test. Qualitative data will be presented in the form of pictures and description tables.

RESULTS AND DISCUSSION

From observations it was found that the exposure of repeated gamma irradiation at dose of 2 gy influenced significantly on the length of estrous cycles (shown in the following tables and figures).

Table 1: The length of estrous cycle (day) of female mice (*Mus musculus* L.) exposed to repeated gamma radiation

No	Treatment	Length of the estrous cycle (day)
1	K (control)	4.40 ± 0.29 a
2	P1 (30 days)	3.70 ± 0.30 a
3	P2 (50 days)	5.10 ± 0.24 a
4	P3 (70 days)	7.20 ± 0.96 b

The results showed that the weight of the ovaries and uterus of female mice (*Mus musculus L.*) exposed to gamma radiation repeatedly showed the difference was not significant ($P = 0.60$). While the results of the ANOVA test against siklus estrus female mice (*Mus musculus L.*) exposure to gamma radiation repeatedly showed significant differences ($P = 0.002$).

The length of estrous cycles of female rats exposed to repeated gamma radiation showed significant differences. This is likely due to damage of ovarian cells exposed to repeated doses of radiation. As it is known that gamma radiation is an ionizing radiation, which means that this radiation is able to ionise the material in its path, in this case the cells of the ovaries. Cells which actively divided as blood cells and ovarian gametes, are very sensitive to the effect of radiation. The research results of Qomariah⁹ showed a decrease in the quantity of haemopoietic cells i.e. cells CD34 and B220 that were irradiated with gamma rays, this decrease of quantity parallel with the increasing doses of

gamma rays. Quantity of these cells decreased due to damage of the DNA in the chromosomes so that the cells become necrotic¹⁰.

Radiation changed the characteristic of nucleus and cytoplasm. Cells of de Graaf follicle are very sensitive to the effects of radiation. Radiation also trigger changes in the production of hormones produced by the gonadal glands that contribute to the development of ovarian cells. Damage to cells in the ovaries affected the production of reproductive hormones such as estrogen and progesterone. Decreasing concentration of estrogen and progesterone in the plasma will affect the estrous cycle in mice. Low levels of estrogen hormone will lengthen the estrous cycle in mice. This is consistent with the results of Lee¹¹ that there was a decrease level of estrogen and progesterone in blood plasma of irradiated mice. The decrease was due to hormonal regulation i.e. inactivated enzyme or hydroxy steroid dehydrogenase and isomerase enzyme in the theca cells, and also blocked the activity of granulosa cells in the follicle.

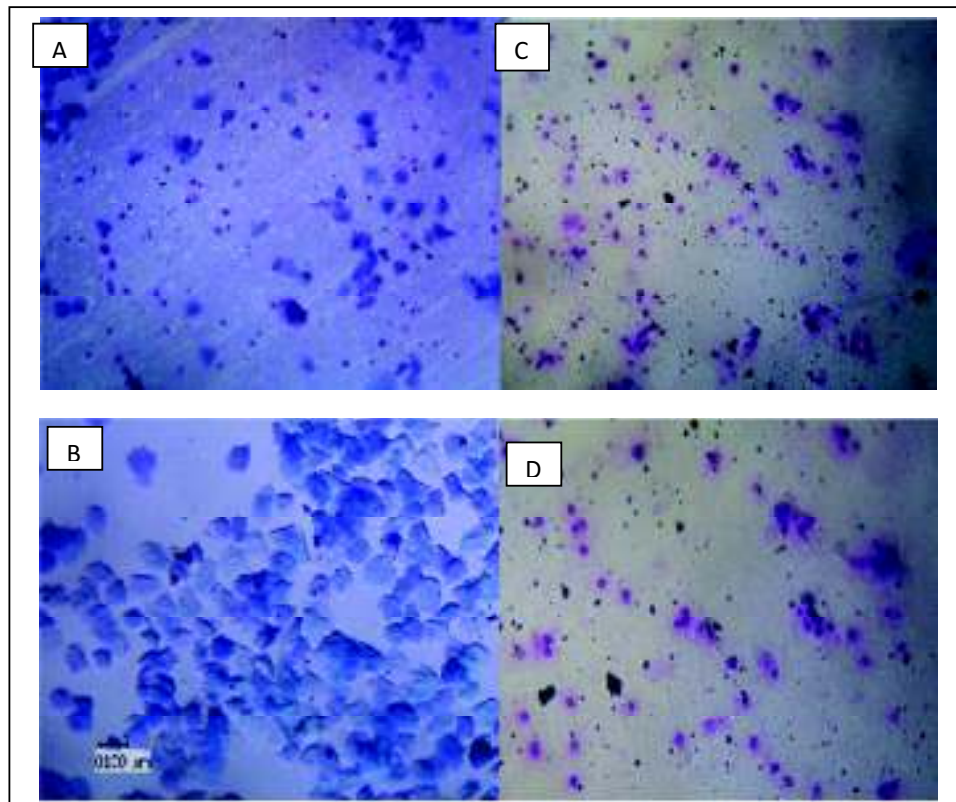


Fig. 1: Stages of the estrous cycle in vaginal smear of female mice (*Mus musculus L.*) irradiated with gamma-rays. Description: A. Proestrus phase, B. Estrus phase, C. Metestrus phase, and D. Diestrus phase (magnification 100x, Giemsa staining)

The results study of Cahyati *et al.*¹² was also in line with the above statement that the dysfunction of the ovary and stress as well as decrease in estrogen hormone of mice due to radiation exposure, and also another radiation effects was premature menopause. The decline of these hormones due to an increase in free radicals from radiation exposure resulting in an increase usage of gamma oxidant enzymes then cells become damaged. Likewise, the results of research of Dicu *et. al.*¹³ showed an increase number of ovarian cells that died after exposure of cytotoxic gamma radiation. The number of dead cells of radiation-induced ovarian affected the production of hormone i.e. estrogen and progesterone. Estrogen and progesterone hormones produced an effect on the epithelial layer of vaginal walls dan estrous cycles. Low estrogen levels will prolong the estrous cycle, or in other words, lowering fertility, and too low estrogen levels can trigger early menopause.

CONCLUSION

Estrous cycle becomes longer in mice (*Mus musculus* L.) treated with repeated gamma radiation.

ACKNOWLEDGEMENT

The author thank to the Institute of Research and Services of Udayana University (LPPM UNUD) that has provided research funding. We also thank to the Radiology Unit of Sanggah Hospital which has provided facilities for radiation treatments.

REFERENCES

1. Tedy. Radioaktivitas-Sinar gamma. 2009. Available at: <http://kliktedy.wordpress.com/2009/10/20/radioaktivitas-sinar-gamma/>
2. Baker, M. Role of Epigenetic Change in Direct and Indirect Radiation Effects. Univercity of Lethbrigde. Canada.pp. 144. (2008).
3. Balentova, S. and Racecova, E., Effects of Low Dose Irradiation on Proliferation Dinamic Rostal Migration Steam of Adult Rats. *Folia Biologica*. **53 (1)**: 74-75. (2007).
4. Sudatri, N.W., Ni Made Suartini, Anak Agung Sagung Alit Sukmaningsih, Dwi Ariani Yulihastuti. Kualitas Spermatozoa Mencit yang Terpapar Radiasi Sinar-X Secara Berulang. *Jurnal Veteriner*. **16(1)**: 51-56 (2015)
5. Suharjo, Efek Radiasi Dosis Tunggal Pada Sel Spermatogenik Mencit Dewasa Strain Quacker Bush (CSL). *Jurnal Bionatura*. **4 (2)**: 87-95 (2002).
6. Yamasaki, Hideki., Moses A. Sandrof and Kim Boekelheide. Suppression of Radiation-Induced Testicular Germ Cell Apoptosis by 2,5-Hexanedione Pretreatment. I. Histopathological Analysis Reveals Stage Dependence of Attenuated Apoptosis. *Toxicological Sciences*. **117(2)**: 449-456 (2010).
7. Zhang, H., Wei, Z.Q., Li, W.J., Li, Q., Dang, B.R., Chen, W.Q., Xie, H.M., Zhang, S.M., He, J., Huang, T., Zheng, R.L., Effects of 16O+6 ion irradiation on human sperm spontaneous chemiluminescence, motility,acrosome reaction and viability *in vitro*. *Pubmed*. **32(1)**: 1-6 (1999).
8. Rina, P., Intan Wiratmini, Ni Wayan Sudatri. Pengaruh Pemberian Rhodamin B Terhadap Siklus Estrus Mencit (*Mus musculus* L) Betina. *Jurnal Biologi*. **17(1)**: 21-23 (2013).
9. Qomariyah, N., Muhaimin Rifa'I,Unggul, P., Juswono. Efek Paparan Radiasi Gamma Terhadap Sel Hematopoietik pada Sumsum Tulang. *Natural B*. **2(1)**: (2013).
10. Dias, F. da Luz, Lusânia M.G. Antune and Catarina S. Takahashi. Effect of taxol on chromosome aberrations induced by gamma radiation or by doxorubicin in Chinese hamster ovary cells . *Braz. J. Genet*. **20(3)**: (1997).
11. Lee, Y.K., Hwa-Hyoung, Chang, Won-Rok Kim1, Jin Kyu Kim,And Yong-Dal Yoon. Gamma-Radiation And Ovarian Folliclesarh Hig Rada. *Toksikol. L* **49(2)**: 147-153 (1998).
12. Cahyati, Y., Didik rahadi Setyo, Unggul . P.Juswono. Efek Radiasi pada Penurunan Estrogen yang Disertai Konsumsi Isoflavopon untuk Mencegah Menopause Dini pada TerapiRadiasi. *Jurnal Natur B*. (2012).
13. Dicu, T., Brie, I.,Virag, P., Perde, M., Genotoxic effects of Cobalt-60 on Chinese Hamster Ovary Cell. *Nucleotica*. **53(4)**: 161-165 (2008).