



Journal of BIOLOGICAL ENGINEERING RESEARCH AND REVIEW

an official Journal of the SB Publications (a unit of Shanti Braj Educational & Welfare Society)

e-ISSN: 2349-3232

Select Language ▼

(<http://www.biologicalengineering.in>)

HOME () EDITORIAL BOARD (EDITORIAL-BOARD/) INSTRUCTIONS FOR AUTHORS (INSTRUCTIONS-FOR-AUTHORS/)

SUBMIT A MANUSCRIPT (SUBMIT-A-MANUSCRIPT/) ARCHIVE (ARCHIVE/) INDEXING (INDEXING/) CALL FOR PAPERS (CALL-FOR-PAPERS/)

Editorial Board

EDITORIAL POLICIES (EDITORIAL-POLICIES/)

PUBLICATION ETHICS AND MALPRACTICE STATEMENT (PUBLICATION-ETHICS-AND-MALPRACTICE-STATEMENT/)

OPEN ACCESS POLICY (OPEN-ACCESS-POLICY/)

COPYRIGHT POLICY (COPYRIGHT-POLICY/)

PUBLICATION FEES (PUBLICATION-FEES/)

PEER REVIEW PROCESS (PEER-REVIEW-PROCESS/)

STANDARDS AND AFFILIATIONS (STANDARDS-AND-AFFILIATIONS/)

WHY PUBLISH WITH US (WHY-PUBLISH-WITH-US/)

INDEXING (INDEXING/)

ABOUT SOCIETY (SBEWS) (ABOUT-SOCIETY-SBEWS/)



Editor-in-Chief
Prof. D. V. Rai

Email: drdvrai@gmail.com
Contact No.: +91-9548766670

ORCID (<https://orcid.org/0000-0001-8693-1620>) SCOPUS (<https://www.scopus.com/authid/detail.uri?authorId=7007192221>)

Managing Editor

Prof. Anoop Swarup
India
Email: swarupanoop@gmail.com

Bio-sketch (<http://www.biologicalengineering.in/gallery/prof.%20anoop%20swarup.pdf>)
Wikipedia (https://en.wikipedia.org/wiki/Anoop_Swarup) **Linked in** (<https://www.linkedin.com/in/dranoopswarup>)

Associate Editors



Dr. Santosh Kumar
Portugal
Email: santoshics@gmail.com

Bio-sketch (<https://ukccsrc.ac.uk/membership/member/santosh-kumar>)
ResearchGate (https://www.researchgate.net/profile/Santosh_Kumar32)

Email: biotech.satishsai@gmail.com

ORCID (<https://orcid.org/0000-0003-1630-3324>) SCOPUS (<https://www.scopus.com/authid/detail.uri?authorId=3707947949>)

Assistant Editor



Dr. Gaurav Kumar
India
Email: info@biologicalengineering.in; gauravkumar.sbme@galgotiasuniversity.edu.in

Bio-sketch (<https://www.mendeley.com/profiles/gaurav-kumar84/>) **ResearchGate** (https://www.researchgate.net/profile/Gaurav_Kumar25) SCOPUS (<https://www.scopus.com/authid/detail.uri?authorId=57188961955>) **Google Scholar** (<https://scholar.google.co.in/citations?user=5COxhvEAAA&hl=en>) **Publons** (<https://publons.com/researcher/1405363/gaurav-kumar/>) ORCID (<https://orcid.org/0000-0003-2823-8419>) **Loop** (<https://loop.frontiersin.org/people/503311/overview>)



Prof. Abilio José Fraga do Nascimento Sobral
Portugal
Email: asobral@ci.uc.pt
Scopus Author ID: 7004085430 ResearcherID: F-5305-2014 Orcid ID:0000-0001-6367-027X



Prof. R. K. Saxena
India
Email: rksaxena369@gmail.com
Area: Experimental Biomechanics, Rehabilitation, Orthopedics
Bio-sketch (<gallery/prof.%20r.%20k.%20saxena.pdf>) **LinkedIn** (<https://www.linkedin.com/in/r-k-saxena-61622534>)

Prof. Baljinder Singh
India



Deputy Editor-in-Chief
Prof. Ranjana Patnaik

Email: rpatnaik.bme@iitbhu.ac.in
Contact No.: +91-9453984462

ORCID (<https://orcid.org/0000-0002-8131-177X>) SCOPUS (<https://www.scopus.com/authid/detail.uri?authorId=7007192221>)

Prof. J. Behari
India
Email: jbehari@hotmail.com

Bio-sketch (<gallery/prof.%20j.%20behari.pdf>)

SCOPUS (<https://www.scopus.com/authid/detail.uri?authorId=7005685171>)

Dr. Anju Verma

Colombia
Email: vermaan@missouri.edu

Bio-sketch (<gallery/dr.%20anju%20verma.pdf>)

Google Scholar (<https://scholar.google.co.in/citations?user=REb15zAAAA&hl=en&oi=ao>)
Email: jayamanduz005@gmail.com

Bio-sketch (<http://>) SCOPUS (<https://www.scopus.com/authid/detail.uri?authorId=9375538399>)



(<http://creativecommons.org/licenses/by/4.0/>)
This work is licensed under a Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>)



Email: drbsingh5144@yahoo.com

Area: Nuclear Medicine, Cancer, PET-CT Molecular Imaging

Bio-sketch ([gallery/prof.%20baljinder%20singh.pdf](#)) **PubMed**

(<http://www.ncbi.nlm.nih.gov/pubmed/?term=Singh%20B%5D>)



Prof. Jagannath Sahoo

India

Email: drjsahoo@gmail.com

Area: Orthopedics

Bio-sketch ([gallery/prof.%20j.%20sahoo.pdf](#)) **PubMed** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Jagannath+Sahoo%5Bauth%5D>)



Prof. Rashmi Mathur

India

Email: mathurashmi@yahoo.co.in

Area: Neurophysiology of pain, neural tissue transplantation

bio-sketch (<http://>) **PubMed** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Rashmi+Mathur%5Bauth%5D>)



Prof. D. K. Dhawan

India

Email: dhawan@pu.ac.in

Area: Nuclear Medicine, Radiation Biophysics, Cancer research

Bio-sketch ([gallery/prof.%20d.%20k.%20dhawan.pdf](#)) **PubMed**

(<http://www.ncbi.nlm.nih.gov/pubmed/?term=DHAWAN+DK%5Bauth%5D>)



Prof. T S Kehwar

USA

Email: drkehwar@gmail.com

Area: Radiation Biophysics, Radiation Oncology

bio-sketch (<http://>) **PubMed** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Kehwar+TS%5BAuthor%5D>)



Prof. H.D. Khanna

India

Email: hdkhanna@yahoo.co.in

Area: Free Radicals and antioxidants, Biomarker, tumor biology

Bio-sketch ([gallery/prof.%20h.d.%20khanna.pdf](#)) **PubMed** (http://www.ncbi.nlm.nih.gov/pubmed/?term=Khanna%20HD%5BAuthor%5D&cauthor=true&cauthor_uid=26676080)



Prof. Raj Bahadur

India

Area: General Orthopedic Surgery, Orthopedic Education, Spinal Surgery, Joint Replacement.

Bio-sketch ([gallery/prof.%20raj%20bahadur.pdf](#)) **PubMed** (http://www.ncbi.nlm.nih.gov/pubmed/?term=Bahadur%20R%5BAuthor%5D&cauthor=true&cauthor_uid=27354946)



Prof. Lalit Mohan Aggarwal

India

Email: imaggarwal@yahoo.com, lalitm@bhu.ac.in

Area: Radiological Physics

Bio-sketch (<http://www.bhu.ac.in/ims/rrm/bio%20data/bio/LMagarwal.pdf>) **PubMed**



Dr. Kirpal Kohli

Canada

Email: kkohli@bccancer.bc.ca

Area: Cancer research, Biophysics, Biomedical Engineering

Bio-sketch ([gallery/dr.%20kirpal%20kohli.pdf](#)) **PubMed**

(<http://www.ncbi.nlm.nih.gov/pubmed/?term=Kirpal+Kohli%5BAuthor%5D>)

Scientific Integrity Advisors



Dr. Pallab Bhattacharya
India

Email: pallab.bhu@gmail.com

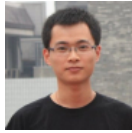
Bio-sketch
(<http://www.niperahm.ac.in/dr-pallab-bhattacharya.htm>)
ResearchGate



Dr. Sudip Paul
India

Email: spaul@nehu.ac.in

Bio-sketch
(<http://nehu.ac.in/faculty/display/344>)
ResearchGate



Dr. Xiaohu (Shawn) Huang
USA

Email: huangxh08@gmail.com

Bio-sketch

([gallery/dr.%20huang%20x-cv.pdf](#)) **ResearchGate**

(https://www.researchgate.net/profile/Xiaohu_Huang)



Dr. Amit K. Tripathi
India

Email: amitibt2008@gmail.com

Google Scholar

(https://scholar.google.co.in/citations?user=_75CjCgAAAAJ&hl=en)

ResearchGate

Disclaimer: Articles on Journal of BIOLOGICAL ENGINEERING RESEARCH AND REVIEW have been previewed and authenticated by the Authors before publishing online. The Journal, Editor and the editorial board are not entitled or liable to either justify or responsible for inaccurate and misleading data if any. It is the sole responsibility of the Author concerned. If any queries or infringement occurs, subject to PATNA jurisdiction.

© 2018 biologicalengineering.in
(<http://biologicalengineering.in>)

(<https://www.zyro.com/page/42006010782049013334/about>)

of-

Biological-

Engineering-

Research-

and-

Review-

JBERR/420060101470456)

Powered by

Zyro

(<http://uk.zyro.com/>)



EDITORIAL POLICIES
(EDITORIAL-POLICIES/)

PUBLICATION ETHICS AND
MALPRACTICE STATEMENT
(PUBLICATION-ETHICS-
AND-MALPRACTICE-
STATEMENT/)

OPEN ACCESS POLICY
(OPEN-ACCESS-POLICY/)

COPYRIGHT POLICY
(COPYRIGHT-POLICY/)

PUBLICATION FEES
(PUBLICATION-FEES/)

PEER REVIEW PROCESS
(PEER-REVIEW-PROCESS/)

STANDARDS AND
AFFILIATIONS (STANDARDS-
AFFILIATIONS/)

WHY PUBLISH WITH US
(WHY-PUBLISH-WITH-US/)

INDEX & COPERNICUS
> JOIN US AS REVIEWER
(JOIN-US-AS-REVIEWER/)

ABOUT SOCIETY (SBEWS)
(ABOUT-SOCIETY-SBEWS/)

(Jan.- June 2016) Vol. 3 Issue 1

CONTACT (CONTACT/)

Technological interventions in Biology

Dr. Anju Verma

Editorial

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016

[Full Text \(pdf\)](#)

(gallery/editorial_jberr_dr.%20anju%20verma.pdf)

Comparison of quality of spermatozoa from the excurrent ducts of Philippine local chicken retrieved by swim-up or mincing methods

Victoria B. Salting^{1*}, Floferfida P. Aquino², Ma. Elizabeth DC. Leoveras³, Lerma C. Ocampo¹, Eufrocina P. Atabay¹, Angeles M. de Leon³

¹Philippine Carabao Center Headquarters and Gene Pool, Science City of Muñoz, Nueva Ecija, Philippines

²Philippine Carabao Center, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines

³Department of Biological Sciences, Central Luzon State University, Philippines

Research Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 01-05

[Full Text \(pdf\)](#)

(<gallery/16-3-1-01.pdf>)

Homology Modeling and Structural Assessment of CuNiR of *Pseudomonas Chlororaphis* Subsp. *Aureofaciens* Nirk

Utpal Kumar Adhikari, Ferozur Rahman, Md. Mostaq Ahmmed, Md. Razib chowdhury, Shahidur Rahman, M. Mizanur Rahman*

Department of Biotechnology and Genetic Engineering. Faculty of Applied Science and Technology, Islamic University, Kushtia, Bangladesh

Research Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 06-15

[Full Text \(pdf\)](#)

(<gallery/16-3-1-02.pdf>)

Analysis of Genetic Variation between five Banana Fruit Varieties by RAPD Markers

(<gallery/16-3-1-03.pdf>)

Md. Rakibul Islam*, Abul Kalam Azad, Md. Abuhena, Ratikanta Haldar, Shahidur Rahman

Department of Biotechnology and Genetic Engineering. Faculty of Applied Science and Technology, Islamic University, Kushtia, Bangladesh

Research Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 16-20

[Full Text \(pdf\)](#)

(<gallery/16-3-1-03.pdf>)

A Review on Theories Regarding Ageing (<gallery/16-3-1-03.pdf>)

DN Pandit, RR Singh, SP Srivastava

Department of Zoology, VKS University, Arrah-802 301

Review Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 21-25

[Full Text \(pdf\)](#)

(<gallery/16-3-1-04.pdf>)

Biodiversity of Edible Macrofungi from Alas Purwo National Park

Alfin N. Firdaus, Fatimah A. Mustofa, Zulia Citra, Nenik F. Ummah, Fitriana Martiani, Ranu Bagus, Nabilatun Nisa, Silvia K. Sari, Arif Nur Muhammad Ansori*, Ni'matuzahroh

Biology Department, Faculty of Science and Technology, Kampus C Universitas Airlangga, Surabaya, 60115, Indonesia

Research Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 26-29

[Full Text \(pdf\)](#)

(<gallery/16-3-1-05.pdf>)

Use of effective microorganisms on enhancing the mycelial growth of *Pleurotus florida* on unsterilized rice straw

Kathrina M. Mapanao^{*1}, Evaristo A. Abella², Daniel L. Aquino³, Sofronio P. Kalaw²



(<http://creativecommons.org/licenses/by/4.0/>)

This work is licensed under a
Creative Commons Attribution
4.0 International License

(<http://creativecommons.org/licenses/by/4.0/>)

¹Department of Biological Sciences, College of Arts and Sciences, Central Luzon State University, Science City of Muñoz, Nueva Ecija, 3120

²Center for Tropical Mushroom Research and Development, Central Luzon State University, Science City of Muñoz, Nueva Ecija, 3120

³Philippine Carabao Center, Central Luzon State University, Science City of Muñoz, Nueva Ecija, 3120

Research Paper *J. Biol. Engg. Res. & Rev.*, Vol. 3, Issue 1, 2016, 30-36 Full Text (pdf)
(gallery/16-03-01-06.pdf)

Wash Resistance and Bioefficacy of PermaNet® 2.0, PowerNet and K-O-Tab 123 Treated Bed Nets against Malaria Vectors of Myanmar

Maung Maung Mya¹, Pe Than Htun¹, Myat Phone Kyaw¹, Sein Min¹, Sein Thaug¹, R.K.Saxena^{2*}

¹Department of Medical Research (Lower Myanmar), Yangon, Myanmar

²Centre for Biomedical Engineering, Shobhit University, Modipuram, India

Research Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 37-43

Full Text (pdf)

(gallery/16-3-1-07.pdf)

Phytochemical screening and antibacterial testing of different varieties of Morus spp. (Mulberry)

Job U. Ramos*, Eden S. David, Kristine Grace D. Waing

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

Research Paper

J. Biol. Engg. Res. & Rev., Vol. 3, Issue 1, 2016, 44-48

Full Text (pdf)

(gallery/16-3-1-08.pdf)

Disclaimer: Articles on Journal of BIOLOGICAL ENGINEERING RESEARCH AND REVIEW have been previewed and authenticated by the Authors before publishing online. The Journal, Editor and the editorial board are not entitled or liable to either justify or responsible for inaccurate and misleading data if any. It is the sole responsibility of the Author concerned. If any queries or infringement occurs, subject to PATNA jurisdiction.

© 2018 biologicalengineering.in
(<http://biologicalengineering.in>)

(<https://www.google.com/search?q=biological+engineering+research+and+review&rlz=C306600782049013334/about>)
of-
Biological-
Engineering-
Research-
and-
Review-
JBERR/420060101470456)

Powered by
Zyro
(<http://uk.zyro.com/>)

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/304037620>

Biodiversity of Edible Macrofungi from Alas Purwo National Park

Article in *Journal of Biological Engineering Research and Review* · April 2016

CITATION

1

READS

284

10 authors, including:



Fitriana Martiani

Airlangga University

1 PUBLICATION 1 CITATION

SEE PROFILE



Nabilatun Nisa

Airlangga University

1 PUBLICATION 1 CITATION

SEE PROFILE



Silvia Kurnia Sari

Airlangga University

4 PUBLICATIONS 4 CITATIONS

SEE PROFILE



Arif Nur Muhammad Ansori

Airlangga University

36 PUBLICATIONS 81 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



ratna wahyuni [View project](#)



Screening of Cellulolytic Bacteria From Alas Purwo National Park to Produce Cellulase [View project](#)



Research Article

Biodiversity of Edible Macrofungi from Alas Purwo National Park

Alfin N. Firdaus, Fatimah A. Mustofa, Zulia Citra, Nenik F. Ummah, Fitriana Martiani, Ranu Bagus,

Nabilatun Nisa, Silvia K. Sari, Arif Nur Muhammad Ansori*, Ni'matuzahroh

Biology Department, Faculty of Science and Technology, Kampus C Universitas Airlangga, Surabaya, 60115, Indonesia

*E-mail: arif.nma-12@fst.unair.ac.id

ARTICLE INFO:

Article History:

Received: 28/01/2016
Revised: 29/03/2016
Accepted: 03/04/2016
Available Online: 04/04/2016

Keywords:

Alas Purwo National Park,
Alternative Food Sources,
Biodiversity,
Ecosystem,
Edible Macrofungi,
Nutritional Value,
Tropical Rainforest

Abstract: This research aimed to invent edible macrofungi in Alas Purwo National Park that can be used as alternative food sources. The method that was used in this research was the explorative method with descriptive analysis. The sampling process took place along the side trail of the tropical rainforest ecosystem of Alas Purwo National Park. The tropical rainforest ecosystem that was reached from Triangulasi Resort with geographics coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to northwest for around three kilometres until Sadengan Track with geographics coordinates 8° 39' 13.1" S 114° 22' 18.2" E. The other track was from Trangulasi Resort with geographics coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to east for around five kilometres until Pancur Track with geographics coordinates 8° 40' 38.91" S 114° 22' 25.90" E. The collections of macrofungi samples were limited until five metres left and five metres right of the track. The result of this research showed there were 40 different genera and 22 of them are edible. Those 22 genera are *Auricularia*, *Cantharellus*, *Clavulina*, *Collybia*, *Coltricia*, *Coprinus*, *Crepidotus*, *Dictyophora*, *Flammulina*, *Geastrum*, *Hydnellum*, *Inocybe*, *Leucocoprinus*, *Marasmius*, *Meripilus*, *Mycena*, *Oligoporus*, *Peziza*, *Pleurotus*, *Polyporus*, *Psathyrella*, and *Tremella*.

INTRODUCTION

Indonesia is a tropical country with very high biodiversity rate, including the diversity of macrofungi. There are approximately 80,000 species of fungi in Indonesia considering the humidity and tropical temperature that are supporting the growth of fungi [1]. Macrofungi is one of the biological resource, which play important roles in human life.

Alas Purwo National Park is one of the national parks located in East Java, Indonesia (Figure 1). Historically, this area was established as a nature monument in 1913 and declared as a national park in 1992. This is a 42,000 ha lowland forest that is the best-known habitat for the spectacular wildlife in Java [2]. Alas Purwo National Park is one of representative tropical rain forest in eastern java which has natural condition supporting biodiversity of macrofungi because of its humidity and high rain precipitation. Ansori *et al.* (2014) found 17 genera of edible macrofungi from Meru Betiri National Park [3]. On the other hand, there are not data about biodiversity of edible macrofungi from Alas Purwo National Park.

The potential of macrofungi in general is its function as decomposer, but some macrofungi are edible and therefore potential for a food source [4]. Some macrofungi are edible because it has fruit body, not poisonous, and has nutritional value [5]. Edible macrofungi has high protein with complete

amino acid including the essential amino acid which human needs and also contains vitamin B complex [4, 6, 7, 8] and some mineral salt from the elements of Ca, P, Fe, Na, and K [4, 9, 10, 11]. Biodiversity and potential of macrofungi in Indonesia is still has not known much. The inventory of edible macrofungi from Alas Purwo National Park aims to make records of macrofungi, which can be utilized, as alternative food sources.

MATERIALS AND METHODS

This research is done for two days, started from February 18th-19th 2015 in Alas Purwo National Park. The selected location for macrofungi sampling is alongside the trail of the tropical rainforest ecosystem of Alas Purwo National Park. The area in the first day reached from Triangulasi Resort with geographic coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to northwest for around three kilometres until Sadengan Track with geographics coordinates 8° 39' 13.1" S 114° 22' 18.2" E. In the second day the track was from Trangulasi Resort with geographics coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to east for around five kilometres until Pancur Track with geographics coordinates 8° 40' 38.91" S 114° 22' 25.90" E. The collecting of macrofungi samples was limited until five metres left and five metres right of the track.

The instruments used in this research are digital camera, knife, cutter, scoop, labels, plastic bags, stationery, calipers,

determination and characteristic sheets, latex gloves, soil tester, magnifying glass, *The Complete Encyclopedia of Mushrooms* [5], and *The Great Encyclopedia of Mushrooms* [12] to facilitate observation and identification. The materials used for identification is all the macrofungi that found in Alas Purwo National Park.

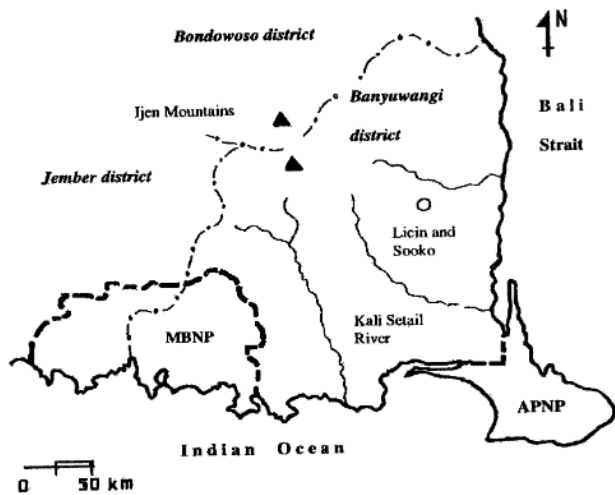


Figure 1. Eastern Part of Java, APNP is Alas Purwo National Park [2]

Samples were photographed with standard comparator such as ruler and calipers. The environmental parameters where the sample grows were also noted, for example substrates (trees, decomposed woods, and soil), soil pH, and substrate temperature. The samples were collected by knife or cutter for macrofungi living in a decomposed tree, whereas for macrofungi living on the decomposed remains above soil is collected using scoop. After the sample is collected, it is placed in a labeled plastic bag.

The collected macrofungi were classified by its fruit body such as cup fungi, puffball fungi, stick fungi, jelly fungi, bracket fungi, and coral fungi. Then, further identification with the character of each macrofungi and type of growth substrates was conducted to determine its genus. The macrofungi edibility potential is known by referring to *The Complete Encyclopedia of Mushrooms* [5] and *The Great Encyclopedia of Mushrooms* [12].

RESULTS AND DISCUSSION

The inventory of edible macrofungi from the tropical rainforest ecosystem of Alas Purwo National Park found 40 genera and 16 unidentified isolates because of the characters were not matching to the references. From 40 genera, 22 genera were identified into edible macrofungi (Table 1). Edible macrofungi has fruit body, not poisonous, and has nutritional value [5]. From the tropical rainforest ecosystem of Alas Purwo National Park, the edible macrofungi were found are *Auricularia*, *Cantharellus*, *Clavulina*, *Collybia*, *Coltricia*, *Coprinus*, *Crepidotus*, *Dictyophora*, *Flammulina*, *Gastrum*, *Hydnellum*, *Inocybe*, *Leucocoprinus*, *Marasmius*, *Meripilus*, *Mycena*, *Oligoporus*, *Peziza*, *Pleurotus*, *Polyporus*, *Psathyrella*, and *Tremella*.

Generally, macrofungi contain 90% water and 10% dry matter. Protein content varies between 27% and 48%, carbohydrates are less than 60% [13], and low-fat [4, 8, 14] only consisting of 2-8% of the dry weight [4, 13]. High protein contents are ideal as a food source for it contains every essential amino acid the body needs [4]. Macrofungi contain all nine amino acids essential for human and they are especially rich in lysine and leucine, which are lacking in most staple cereal foods [15]. Furthermore, it is known that the protein content of macrofungi is about twice that of vegetables and four times that of oranges [16].

Table 1. List of macrofungi genera from the tropical rainforest ecosystem of Alas Purwo National Park

Genera	Edible Macrofungi	Genera	Edible Macrofungi
<i>Xylaria</i>	×	<i>Coprinus</i>	✓
<i>Trametes</i>	×	<i>Polyporus</i>	✓
<i>Thelephora</i>	×	<i>Lenzites</i>	×
<i>Peziza</i>	✓	<i>Mycena</i>	✓
<i>Coriolopsis</i>	×	<i>Phylloporus</i>	×
<i>Phaeolus</i>	×	<i>Collybia</i>	✓
<i>Ganoderma</i>	×	<i>Psathyrella</i>	✓
<i>Meripilus</i>	✓	<i>Dictyophora</i>	✓
<i>Tremella</i>	✓	<i>Clitocybe</i>	×
<i>Gastrum</i>	✓	<i>Coltricia</i>	✓
<i>Leucocoprinus</i>	✓	<i>Pleurotus</i>	✓
<i>Hydnellum</i>	✓	<i>Xerula</i>	×
<i>Inocybe</i>	✓	<i>Marasmius</i>	✓
<i>Flammulina</i>	✓	<i>Clavulina</i>	✓
<i>Omphalina</i>	×	<i>Stereum</i>	×
<i>Crepidotus</i>	✓	<i>Cantharellus</i>	✓
<i>Calocybe</i>	×	<i>Lactarius</i>	×
<i>Cudoniella</i>	×	<i>Pycnoporus</i>	×
<i>Auricularia</i>	✓	<i>Hygrophorus</i>	×
<i>Oligoporus</i>	✓	<i>Amanita</i>	×

The fruit body of edible macrofungi is a great source of vitamin B complex [4, 6, 7, 8]. Vitamin B complex consists of riboflavin (B2), niacin (B3), thiamine (B1), biotin, folic acid, and vitamin B12. One hundred grams of fresh macrofungi gives more than 25% vitamins needed by an adult per day. Macrofungi is unique because it contains vitamin B12 which not every vegetable has. In each gram of macrofungi contain 0.32 to 0.65 mg vitamin B12. Niacin is essential for forming enzymes needed to transform sugar into energy, also maintaining body tissues to keep healthy. Riboflavin is needed to process nutrients such as vitamin B6, niacin, and folic acid to a simpler form which can be utilized by the body [4]. The Figure 2 shows a kind of edible macrofungi from Alas

Purwo National Park, *Dictyophora indusiata* or bamboo fungus.

Macrofungi cultivation in Indonesia is relatively advanced compared to other countries such as China, Japan, Taiwan, France, Italy, United States, and others [17]. Currently, around 30 species of edible macrofungi cultivated commercially and only 15 species are produced on an industrial scale [18]. In Indonesia, there are some species of macrofungi that have been known and cultivated, such as *Volvariella*, *Agaricus*, *Pleurotus*, *Auricularia*, *Lentinus*, *Flammulina*, *Velutipes*, and *Grifola* [17]. From the tropical rainforest ecosystem of Alas Purwo National Park, it is found that 22 genera have potential for a food source. This fact increased the information about diversity of edible macrofungi which can be cultivated as alternative food sources.



Figure 2. An edible macrofungi from Alas Purwo National Park, *Dictyophora indusiata* or bamboo fungus

CONCLUSION

Genera of edible macrofungi from the tropical rainforest ecosystem of Alas Purwo National Park are *Auricularia*, *Cantharellus*, *Clavulina*, *Collybia*, *Coltricia*, *Coprinus*, *Crepidotus*, *Dictyophora*, *Flammulina*, *Geastrum*, *Hydnellum*, *Inocybe*, *Leucocoprinus*, *Marasmius*, *Meripilus*, *Mycena*, *Oligoporus*, *Peziza*, *Pleurotus*, *Polyporus*, *Psathyrella*, and *Tremella*. Furthermore, this result should be a reference for further exploration and increased the information about diversity of edible macrofungi in Alas Purwo National Park as alternative food sources.

ACKNOWLEDGEMENTS

Special thanks to Alas Purwo National Park for giving facilities and permission to do this research, Himpunan

Mahasiswa Biologi (HIMBIO) Universitas Airlangga which held P3L 2015 at Alas Purwo National Park, also Microbiology Study Club HIMBIO Universitas Airlangga which formed Mushroom Research Group for P3L 2015 at Alas Purwo National Park.

COMPETING INTERESTS: The author has declared that no competing interests exist.

REFERENCES

1. Lembaga Ilmu Pengetahuan Indonesia. Kekinian Keanekaragaman Hayati Indonesia. Jakarta: LIPI Press; 2014.
2. Whitten T, Soeriaatmadja RE, Affif SA. The Ecology of Indonesian Series Volume II: The Ecology of Java and Bali. Singapore: Periplus Editions (HK) Ltd; 1996.
3. Ansori ANM, Fusvita L, Trikurniadewi N, Rahmanyah F, Arizal EH, Ni'matuzahroh. Inventorization of Edible Macrofungi from the Tropical Rainforest Ecosystem of Meru Betiri National Park East Java. Proceeding of The 5th International Conference on Global Resource Conservation; 2014.
4. Ingram S. The Real Nutritional Value of Fungi. United Kingdom: Cancer Research UK; 2002.
5. Keizer GJ. The Complete Encyclopedia of Mushrooms. The Netherland: Rebo International; 1998.
6. Chang ST, Buswell JA. Mushroom Nutraceuticals. World J Microbiol Biotechnol 1996; 12: 473-476.
7. Mattila PK, Konko M, Euroala J, Pihlava J, Astola L, Vahteristo V, et al. Contents of Vitamins, Mineral Elements and Some Phenolic Compounds in the Cultivated Mushrooms. J Agric Food Chem 2000; 49: 2343-2348.
8. Heleno SA, Barros L, Sousa MJ, Martins A, Ferreira ICFR. Tocopherols composition of Portuguese wild mushrooms with antioxidant capacity. Food Chem 2010; 119: 1443-1450.
9. Fasidi IO. Studies on *Volvariella esculenta* (Mass) Singer: Cultivation on Agricultural Wastes and Proximate Composition of Stored Mushrooms. Food Chem 1996; 55: 161-163.
10. Kuforiji OO, Fasidi IO, Odunfa SA. Nutritive Value of *Pleurotus tuber-regium* Cultivated on Different Agro-industrial Wastes. Nig J Microbiol 2003; 17: 63-67.
11. Ogundana SK, Fagade OE. Nutritive Value of Some Nigerian Edible Mushrooms. Food Chem 1982; 8: 263-268.
12. Lamaison JL, Polese JM. The Great Encyclopedia of Mushrooms. Germany: Konemann; 2005.
13. Crisan EV, Sands A. 1978. Nutritional Value. In: S. T., Chang and W. A., Hayes (Eds). The Biology and Cultivation of Edible Mushrooms. London: Academic Press Inc; 1978. p. 137-165.
14. Buswell JA, Cai YJ, Chang ST, Peberdy JF, Fu SY, Yu HS. Lignocellulolytic Enzyme Profiles of Edible Mushroom Fungi. World J Microbiol Biotechnol 1996; 12: 537-542.

15. Li GSF, Chang ST. Nutritive Value of *Volvariella volvacea*. In: Tropical Mushroom. Biological Nature and Cultivation Methods. Ed. Chang, S. T., Quimio, T. H. Hong Kong: The Chinese University Press; 1982.
16. Chan HKM. Consumption of Edible Mushrooms in Hong Kong. Mushroom Newsletter for the Tropics 1981; 1(4): 5-10.
17. Suharjo E. Budidaya Industri Jamur Konsumsi di Indonesia. Temu Teknis Nasional Tenaga Fungsional Pertanian 2006. Pusat Penelitian dan Perkembangan Peternakan Kementerian Pertanian.
18. Chang ST. Mushroom Production. In: Biotechnology, Vol. VII. Encyclopedia of Life Support Systems (EOLSS). ISBN: 978-1-84826-256-0; 2003.

About Author



Mr. Arif Nur Muhammad Ansori is an undergraduate student of biology in Biology Department, Faculty of Science and Technology Universitas Airlangga. His area of interest are virology, entomology, biodiversity, molecular biology, zoology, botany and mycology. He has received two research grants (2013 and 2014) from Ministry of Research, Technology, and Higher Education - Republic of Indonesia, also received scholarship in 2015 from Ministry of Research, Technology, and Higher Education - Republic of Indonesia.