

Front cover: *Leucopsar rothschildi* Stresemann, 1912  
(PHOTO: SHEAU TORNG LIM)

---

Published monthly

PRINTED IN INDONESIA

ISSN: 1412-033X

E-ISSN: 2085-4722



9 771412 033818



9 772085 472812

ISSN: 1412-033X  
E-ISSN: 2085-4722

# BIODIVERSITAS

**Journal of Biological Diversity**

Volume 21 - Number 10 - October 2020



# BIODIVERSITAS

Journal of Biological Diversity  
Volume 21 – Number 10 – October 2020

ISSN/E-ISSN:

1412-033X (printed edition), 2085-4722 (electronic)

## EDITORIAL BOARD:

**Abdel Fattah N.A. Rabou** (Palestine), **Agnieszka B. Najda** (Poland), **Ajay Kumar Gautam** (India), **Alan J. Lymbery** (Australia), **Annisa** (Indonesia), **Bambang H. Saharjo** (Indonesia), **Daiane H. Nunes** (Brazil), **Darlina Md. Naim** (Malaysia), **Ghulam Hassan Dar** (India), **Hassan Pourbabaei** (Iran), **Joko R. Witono** (Indonesia), **Kartika Dewi** (Indonesia), **Katsuhiko Kondo** (Japan), **Kusumadewi Sri Yulita** (Indonesia), **Livia Wannorp** (Sweden), **M. Jayakara Bhandary** (India), **Mahdi Reyahi-Khoram** (Iran), **Mahendra K. Rai** (India), **Mahesh K. Adhikari** (Nepal), **Maria Panitsa** (Greece), **Mochamad A. Soendjoto** (Indonesia), **Mohib Shah** (Pakistan), **Mohamed M.M. Najim** (Srilanka), **Nurhasanah** (Indonesia), **Praptiwi** (Indonesia), **Rasool B. Tareen** (Pakistan), **Sayed Aliakbar Hedayati** (Iran), **Sayed Mehdi Talebi** (Iran), **Shahabuddin** (Indonesia), **Shahir Shamsir** (Malaysia), **Shri Kant Tripathi** (India), **Subhash C. Santra** (India), **Sugeng Budiharta** (Indonesia), **Sugiyarto** (Indonesia), **Taufiq Purna Nugraha** (Indonesia), **Yosep S. Mau** (Indonesia)

## EDITOR-IN-CHIEF:

**S u t a r n o**

## EDITORIAL MEMBERS:

English Editors: **Graham Eagleton** (grahameagleton@gmail.com), **Suranto** (surantouns@gmail.com); Technical Editor: **Solichatun** (solichatun\_s@yahoo.com), **Artini Pangastuti** (pangastuti\_tutut@yahoo.co.id); Distribution & Marketing: **Rita Rakhmawati** (oktia@yahoo.com); Webmaster: **Ari Pitoyo** (aripitoyo@yahoo.com)

## MANAGING EDITORS:

**Ahmad Dwi Setyawan** (unsjournals@gmail.com)

## PUBLISHER:

The Society for Indonesian Biodiversity

## CO-PUBLISHER:

Department of Biology, Faculty of Mathematics and Natural Sciences, Sebelas Maret University, Surakarta

## ADDRESS:

Jl. Ir. Sutami 36A Surakarta 57126. Tel. +62-271-7994097, Tel. & Fax.: +62-271-663375, email: editors@smujo.id

## ONLINE:

biodiversitas.mipa.uns.ac.id; smujo.id/biodiv

.....



**Society for Indonesia  
Biodiversity**



**Sebelas Maret University  
Surakarta**

## GUIDANCE FOR AUTHORS

**Aims and Scope** *Biodiversitas*, *Journal of Biological Diversity* or abbreviated as *Biodiversitas* encourages submission of manuscripts dealing with all biodiversity aspects of plants, animals and microbes at the level of the gene, species, and ecosystem as well as ethnobiology.

**Article types** The journal seeks original full-length research papers, reviews, and short communication. Manuscript of original research should be written in no more than 8,000 words (including tables and picture), or proportional with articles in this publication number. Review articles will be accommodated, while, short communication should be written at least 2,000 words, except for pre-study.

**Submission** The journal only accepts online submission, through open journal system (<https://smujo.id/biodiv/about/submissions>) or email to the editors at [unsjournals@gmail.com](mailto:unsjournals@gmail.com). Submitted manuscripts should be the original works of the author(s). The manuscript must be accompanied by a cover letter containing the article title, the first name and last name of all the authors, a paragraph describing the claimed novelty of the findings versus current knowledge. Submission of a manuscript implies that the submitted work has not been published before (except as part of a thesis or report, or abstract); and is not being considered for publication elsewhere. When a manuscript written by a group, all authors should read and approve the final version of the submitted manuscript and its revision; and agree the submission of manuscripts for this journal. All authors should have made substantial contributions to the concept and design of the research, acquisition of the data and its analysis; drafting of the manuscript and correcting of the revision. All authors must be responsible for the quality, accuracy, and ethics of the work.

**Ethics** Author(s) must obedient to the law and/or ethics in treating the object of research and pay attention to the legality of material sources and intellectual property rights.

**Copyright** If and when the manuscript is accepted for publication, the author(s) still hold the copyright and retain publishing rights without restrictions. Authors or others are allowed to multiply article as long as not for commercial purposes. For the new invention, authors are suggested to manage its patent before published.

**Open access** The journal is committed to free-open access that does not charge readers or their institutions for access. Readers are entitled to read, download, copy, distribute, print, search, or link to the full texts of articles, as long as not for commercial purposes. The license type is CC-BY-NC-SA.

**Acceptance** The only articles written in English (U.S. English) are accepted for publication. Manuscripts will be reviewed by editors and invited reviewers(double blind review) according to their disciplines. Authors will generally be notified of acceptance, rejection, or need for revision within 1 to 2 months of receipt. The manuscript is rejected if the content does not in line with the journal scope, does not meet the standard quality, inappropriate format, complicated grammar, dishonesty (i.e. plagiarism, duplicate publications, fabrication of data, citations manipulation, etc.), or ignoring correspondence in three months. The primary criteria for publication are scientific quality and biodiversity significance. **Uncorrected proofs** will be sent to the corresponding author by email as .doc or .docx files for checking and correcting of typographical errors. To avoid delay in publication, corrected proofs should be returned in 7 days. The accepted papers will be published online in a chronological order at any time, but printed in the early of each month (12 times).

**A charge** Starting on January 1, 2019, publishing costs waiver is granted to authors of graduate students from **Least Developed Countries**, who first publish the manuscript in this journal. However, other authors are charged USD 250 (IDR 3,500,000). Additional charges may be billed for language editing, USD 75-150 (IDR 1,000,000-2,000,000).

**Reprints** The sample journal reprint is only available by special request. Additional copies may be purchased when ordering by sending back the uncorrected proofs by email.

**Manuscript preparation** Manuscript is typed on A4 (210x297 mm<sup>2</sup>) paper size, in a single column, single space, 10-point (10 pt) Times New Roman font. The margin text is 3 cm from the top, 2 cm from the bottom, and 1.8 cm from the left and right. Smaller lettering size can be applied in presenting table and figure (9 pt). Word processing program or additional software can be used, however, it must be PC compatible and Microsoft Word based (.doc or .rtf, not .docx). **Scientific names** of species (incl. subspecies, variety, etc.) should be written in italic, except for italic sentence. Scientific name (genera, species, author), and cultivar or strain should be mentioned completely for the first time mentioning it in the body text, especially for taxonomic manuscripts. Name of genera can be shortened after first mentioning, except generating confusion. Name of the author can be eliminated after first mentioning. For example, *Rhizopus oryzae* L. UICC 524, hereinafter can be written as *R. oryzae* UICC 524. Using trivial name should be avoided, otherwise generating confusion. **Biochemical and chemical nomenclature** should follow the order of the IUPAC - IUB. For DNA sequence, it is better used Courier New font. Symbols of standard chemical and abbreviation of chemistry name can be applied for common and clear used, for example, completely written butilic hydroxyl toluene (BHT) to be BHT hereinafter. **Metric measurement** use IS denomination, usage other system should follow the value of equivalent with the denomination of IS first mentioning. Abbreviations set of, like g, mg, mL, etc. do not follow by dot. Minus index (m<sup>-2</sup>, L<sup>-1</sup>, h<sup>-1</sup>) suggested to be used, except in things like "per-plant" or "per-plot". **Equation of mathematics** does not always can be written

down in one column with text, in that case can be written separately. **Number** one to ten are expressed with words, except if it relates to measurement, while values above them written in number, except in early sentence. The fraction should be expressed in decimal. In the text, it should be used "%" rather than "percent". Avoid expressing ideas with complicated sentence and verbiage, and used efficient and effective sentence.

**Title** of the article should be written in compact, clear, and informative sentence, preferably not more than 20 words. Name of author(s) should be completely written. **Name and institution** address should also be completely written with street name and number (location), postal code, telephone number, facsimile number, and email address. Manuscript written by a group, author for correspondence along with address is required. First page of the manuscript is used for writing above information.

**Abstract** should not be more than 200 words. **Keywords** is about five words, covering scientific and local name (if any), research theme, and special methods which used; and sorted from A to Z. All important **abbreviations** must be defined at their first mention. **Running title** is about five words. **Introduction** is about 400-600 words, covering the background and aims of the research. **Materials and Methods** should emphasize on the procedures and data analysis. **Results and Discussion** should be written as a series of connecting sentences, however, for manuscript with long discussion should be divided into subtitles. Thorough discussion represents the causal effect mainly explains for why and how the results of the research were taken place, and do not only re-express the mentioned results in the form of sentences. **Concluding** sentence should be given at the end of the discussion. **Acknowledgments** are expressed in a brief; all sources of institutional, private and corporate financial support for the work must be fully acknowledged, and any potential conflicts of interest are noted.

**Figures and Tables** of maximum of three pages should be clearly presented. Title of a picture is written down below the picture, while title of a table is written above the table. Colored figures can only be accepted if the information in the manuscript can lose without those images; chart is preferred to use black and white images. Author could consign any picture or photo for the front cover, although it does not print in the manuscript. All images property of others should be mentioned source. **There is no appendix**, all data or data analysis are incorporated into Results and Discussions. For broad data, it can be displayed on the website as a supplement.

**References** Author-year citations are required. In the text give the authors name followed by the year of publication and arrange from oldest to newest and from A to Z. In citing an article written by two authors, both of them should be mentioned, however, for three and more authors only the first author is mentioned followed by et al., for example: Saharjo and Nurhayati (2006) or (Boonkerd 2003a, b, c; Sugiyarto 2004; El-Bana and Nijs 2005; Balagadde et al. 2008; Webb et al. 2008). Extent citation as shown with word "cit" should be avoided. Reference to unpublished data and personal communication should not appear in the list but should be cited in the text only (e.g., Rifai MA 2007, pers. com. (personal communication); Setyawan AD 2007, unpublished data). In the reference list, the references should be listed in an alphabetical order (better, if only 20 for research papers). Names of journals should be abbreviated. Always use the standard abbreviation of a journal's name according to the **ISSN List of Title Word Abbreviations** ([www.issn.org/2-22661-LTWA-online.php](http://www.issn.org/2-22661-LTWA-online.php)). The following examples are for guidance.

### Journal:

Saharjo BH, Nurhayati AD. 2006. Domination and composition structure change at hemic peat natural regeneration following burning; a case study in Pelalawan, Riau Province. *Biodiversitas* 7: 154-158.

### Book:

Rai MK, Carpinella C. 2006. Naturally Occurring Bioactive Compounds. Elsevier, Amsterdam.

### Chapter in book:

Webb CO, Cannon CH, Davies SJ. 2008. Ecological organization, biogeography, and the phylogenetic structure of rainforest tree communities. In: Carson W, Schnitzer S (eds) *Tropical Forest Community Ecology*. Wiley-Blackwell, New York.

### Abstract:

Assaad AM. 2007. Seed production and dispersal of *Rhazya stricta*. 50<sup>th</sup> annual symposium of the International Association for Vegetation Science, Swansea, UK, 23-27 July 2007.

### Proceeding:

Alikodra HS. 2000. Biodiversity for development of local autonomous government. In: Setyawan AD, Sutarno (eds.) *Toward Mount Lawu National Park; Proceeding of National Seminary and Workshop on Biodiversity Conservation to Protect and Save Germplasm in Java Island*. Universitas Sebelas Maret, Surakarta, 17-20 July 2000. [Indonesian]

### Thesis, Dissertation:

Sugiyarto. 2004. Soil Macro-invertebrates Diversity and Inter-Cropping Plants Productivity in Agroforestry System based on Sengon. [Dissertation]. Universitas Brawijaya, Malang. [Indonesian]

### Information from internet:

Balagadde FK, Song H, Ozaki J, Collins CH, Barnet M, Arnold FH, Quake SR, You L. 2008. A synthetic *Escherichia coli* predator-prey ecosystem. *Mol Syst Biol* 4: 187. [www.molecularsystemsbiology.com](http://www.molecularsystemsbiology.com)


**THIS PAGE INTENTIONALLY LEFT BLANK**

# Biodiversitas

11

H Index

## Country

Indonesia - 

## Subject Area and Category

Agricultural and Biological Sciences  
Animal Science and Zoology  
Plant Science

Biochemistry, Genetics and Molecular Biology  
Molecular Biology

## Publisher

Biology department, Sebelas Maret University Surakarta - 

## Publication type

Journals

## ISSN

1412033X, 20854722

## Coverage

2014-2020

## Scope

"Biodiversitas, Journal of Biological Diversity" or Biodiversitas encourages submission of manuscripts dealing with all biodiversity aspects of plants, animals and microbes at the level of gene, species, and ecosystem.

[Homepage](#)[How to publish in this journal](#)[Contact](#)[Join the conversation about this journal](#)

## Quartiles

Animal Science and Zoology

Molecular Biology

Plant Science

2015

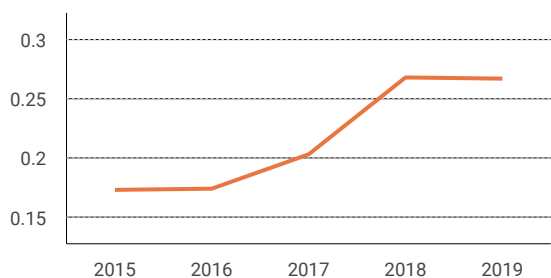
2016

2017

2018

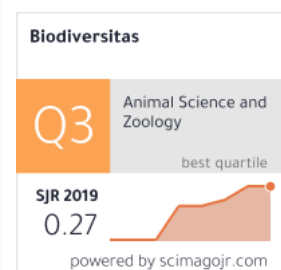
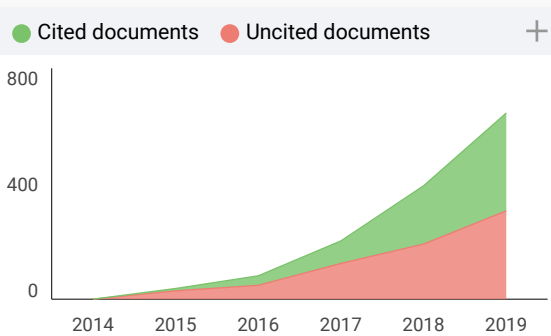
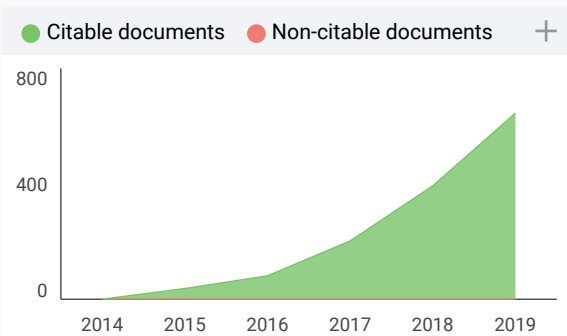
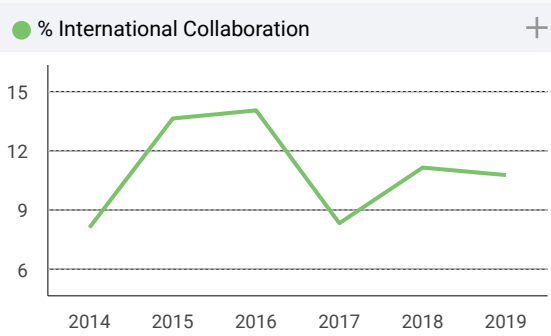
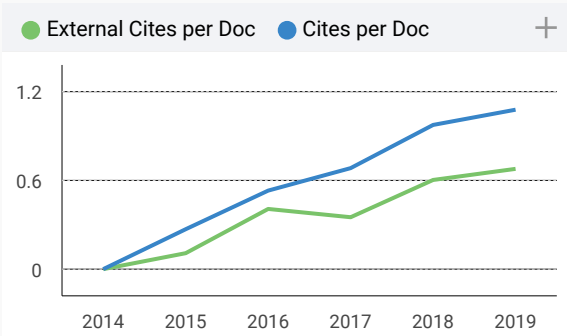
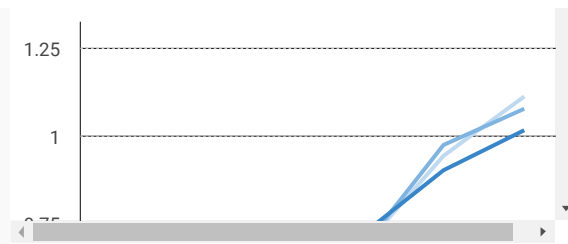
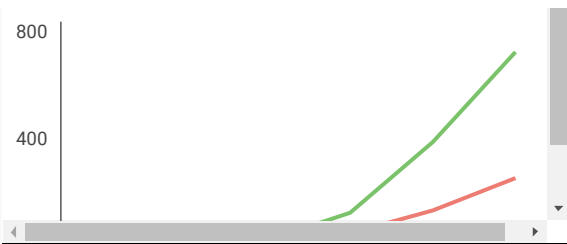
2019

## SJR



Total Cites Self-Cites

## Citations per document



← Show this widget in your own website

Just copy the code below and paste within your html code:

```
<a href="https://www.scimagojr.com" data-bbox="265 575 408 584">
```

Metrics based on Scopus® data as of April 2020



**Rubiyo** 6 days ago

Thank yuo SCImago Team

← reply



**KETUT SUADA** 6 months ago

Dear Editors

May I know the reason/s of Why my article title "The potential of various indigenous *Trichoderma* spp. to suppress *Plasmodiophora brassicae* the pathogen of clubroot disease on cabbage" DOI:

Front cover: *Leucopsar rothschildi* Stresemann, 1912  
(PHOTO: SHEAU TORNG LIM)

---

Published monthly

PRINTED IN INDONESIA

ISSN: 1412-033X

E-ISSN: 2085-4722



9 771412 033818



9 772085 472812



ISSN: 1412-033X  
E-ISSN: 2085-4722

# BIODIVERSITAS

**Journal of Biological Diversity**

Volume 21 - Number 10 - October 2020



# BIODIVERSITAS

Journal of Biological Diversity  
Volume 21 – Number 10 – October 2020

ISSN/E-ISSN:

1412-033X (printed edition), 2085-4722 (electronic)

## EDITORIAL BOARD:

**Abdel Fattah N.A. Rabou** (Palestine), **Agnieszka B. Najda** (Poland), **Ajay Kumar Gautam** (India), **Alan J. Lymbery** (Australia), **Annisa** (Indonesia), **Bambang H. Saharjo** (Indonesia), **Daiane H. Nunes** (Brazil), **Darlina Md. Naim** (Malaysia), **Ghulam Hassan Dar** (India), **Hassan Pourbabaei** (Iran), **Joko R. Witono** (Indonesia), **Kartika Dewi** (Indonesia), **Katsuhiko Kondo** (Japan), **Kusumadewi Sri Yulita** (Indonesia), **Livia Wannorp** (Sweden), **M. Jayakara Bhandary** (India), **Mahdi Reyahi-Khoram** (Iran), **Mahendra K. Rai** (India), **Mahesh K. Adhikari** (Nepal), **Maria Panitsa** (Greece), **Mochamad A. Soendjoto** (Indonesia), **Mohib Shah** (Pakistan), **Mohamed M.M. Najim** (Srilanka), **Nurhasanah** (Indonesia), **Praptiwi** (Indonesia), **Rasool B. Tareen** (Pakistan), **Sayed Aliakbar Hedayati** (Iran), **Sayed Mehdi Talebi** (Iran), **Shahabuddin** (Indonesia), **Shahir Shamsir** (Malaysia), **Shri Kant Tripathi** (India), **Subhash C. Santra** (India), **Sugeng Budiharta** (Indonesia), **Sugiyarto** (Indonesia), **Taufiq Purna Nugraha** (Indonesia), **Yosep S. Mau** (Indonesia)

## EDITOR-IN-CHIEF:

**S u t a r n o**

## EDITORIAL MEMBERS:

English Editors: **Graham Eagleton** (grahameagleton@gmail.com), **Suranto** (surantouns@gmail.com); Technical Editor: **Solichatun** (solichatun\_s@yahoo.com), **Artini Pangastuti** (pangastuti\_tutut@yahoo.co.id); Distribution & Marketing: **Rita Rakhmawati** (oktia@yahoo.com); Webmaster: **Ari Pitoyo** (aripitoyo@yahoo.com)

## MANAGING EDITORS:

**Ahmad Dwi Setyawan** (unsjournals@gmail.com)

## PUBLISHER:

The Society for Indonesian Biodiversity

## CO-PUBLISHER:

Department of Biology, Faculty of Mathematics and Natural Sciences, Sebelas Maret University, Surakarta

## ADDRESS:

Jl. Ir. Sutami 36A Surakarta 57126. Tel. +62-271-7994097, Tel. & Fax.: +62-271-663375, email: editors@smujo.id

## ONLINE:

biodiversitas.mipa.uns.ac.id; smujo.id/biodiv

.....



**Society for Indonesia  
Biodiversity**



**Sebelas Maret University  
Surakarta**

## GUIDANCE FOR AUTHORS

**Aims and Scope** *Biodiversitas*, *Journal of Biological Diversity* or abbreviated as *Biodiversitas* encourages submission of manuscripts dealing with all biodiversity aspects of plants, animals and microbes at the level of the gene, species, and ecosystem as well as ethnobiology.

**Article types** The journal seeks original full-length research papers, reviews, and short communication. Manuscript of original research should be written in no more than 8,000 words (including tables and picture), or proportional with articles in this publication number. Review articles will be accommodated, while, short communication should be written at least 2,000 words, except for pre-study.

**Submission** The journal only accepts online submission, through open journal system (<https://smujo.id/biodiv/about/submissions>) or email to the editors at [unsjournals@gmail.com](mailto:unsjournals@gmail.com). Submitted manuscripts should be the original works of the author(s). The manuscript must be accompanied by a cover letter containing the article title, the first name and last name of all the authors, a paragraph describing the claimed novelty of the findings versus current knowledge. Submission of a manuscript implies that the submitted work has not been published before (except as part of a thesis or report, or abstract); and is not being considered for publication elsewhere. When a manuscript written by a group, all authors should read and approve the final version of the submitted manuscript and its revision; and agree the submission of manuscripts for this journal. All authors should have made substantial contributions to the concept and design of the research, acquisition of the data and its analysis; drafting of the manuscript and correcting of the revision. All authors must be responsible for the quality, accuracy, and ethics of the work.

**Ethics** Author(s) must obedient to the law and/or ethics in treating the object of research and pay attention to the legality of material sources and intellectual property rights.

**Copyright** If and when the manuscript is accepted for publication, the author(s) still hold the copyright and retain publishing rights without restrictions. Authors or others are allowed to multiply article as long as not for commercial purposes. For the new invention, authors are suggested to manage its patent before published.

**Open access** The journal is committed to free-open access that does not charge readers or their institutions for access. Readers are entitled to read, download, copy, distribute, print, search, or link to the full texts of articles, as long as not for commercial purposes. The license type is CC-BY-NC-SA.

**Acceptance** The only articles written in English (U.S. English) are accepted for publication. Manuscripts will be reviewed by editors and invited reviewers(double blind review) according to their disciplines. Authors will generally be notified of acceptance, rejection, or need for revision within 1 to 2 months of receipt. The manuscript is rejected if the content does not in line with the journal scope, does not meet the standard quality, inappropriate format, complicated grammar, dishonesty (i.e. plagiarism, duplicate publications, fabrication of data, citations manipulation, etc.), or ignoring correspondence in three months. The primary criteria for publication are scientific quality and biodiversity significance. **Uncorrected proofs** will be sent to the corresponding author by email as .doc or .docx files for checking and correcting of typographical errors. To avoid delay in publication, corrected proofs should be returned in 7 days. The accepted papers will be published online in a chronological order at any time, but printed in the early of each month (12 times).

**A charge** Starting on January 1, 2019, publishing costs waiver is granted to authors of graduate students from **Least Developed Countries**, who first publish the manuscript in this journal. However, other authors are charged USD 250 (IDR 3,500,000). Additional charges may be billed for language editing, USD 75-150 (IDR 1,000,000-2,000,000).

**Reprints** The sample journal reprint is only available by special request. Additional copies may be purchased when ordering by sending back the uncorrected proofs by email.

**Manuscript preparation** Manuscript is typed on A4 (210x297 mm<sup>2</sup>) paper size, in a single column, single space, 10-point (10 pt) Times New Roman font. The margin text is 3 cm from the top, 2 cm from the bottom, and 1.8 cm from the left and right. Smaller lettering size can be applied in presenting table and figure (9 pt). Word processing program or additional software can be used, however, it must be PC compatible and Microsoft Word based (.doc or .rtf, not .docx). **Scientific names** of species (incl. subspecies, variety, etc.) should be written in italic, except for italic sentence. Scientific name (genera, species, author), and cultivar or strain should be mentioned completely for the first time mentioning it in the body text, especially for taxonomic manuscripts. Name of genera can be shortened after first mentioning, except generating confusion. Name of the author can be eliminated after first mentioning. For example, *Rhizopus oryzae* L. UICC 524, hereinafter can be written as *R. oryzae* UICC 524. Using trivial name should be avoided, otherwise generating confusion. **Biochemical and chemical nomenclature** should follow the order of the IUPAC - IUB. For DNA sequence, it is better used Courier New font. Symbols of standard chemical and abbreviation of chemistry name can be applied for common and clear used, for example, completely written butilic hydroxyl toluene (BHT) to be BHT hereinafter. **Metric measurement** use IS denomination, usage other system should follow the value of equivalent with the denomination of IS first mentioning. Abbreviations set of, like g, mg, mL, etc. do not follow by dot. Minus index (m<sup>-2</sup>, L<sup>-1</sup>, h<sup>-1</sup>) suggested to be used, except in things like "per-plant" or "per-plot". **Equation of mathematics** does not always can be written

down in one column with text, in that case can be written separately. **Number** one to ten are expressed with words, except if it relates to measurement, while values above them written in number, except in early sentence. The fraction should be expressed in decimal. In the text, it should be used "%" rather than "percent". Avoid expressing ideas with complicated sentence and verbiage, and used efficient and effective sentence.

**Title** of the article should be written in compact, clear, and informative sentence, preferably not more than 20 words. Name of author(s) should be completely written. **Name and institution** address should also be completely written with street name and number (location), postal code, telephone number, facsimile number, and email address. Manuscript written by a group, author for correspondence along with address is required. First page of the manuscript is used for writing above information.

**Abstract** should not be more than 200 words. **Keywords** is about five words, covering scientific and local name (if any), research theme, and special methods which used; and sorted from A to Z. All important **abbreviations** must be defined at their first mention. **Running title** is about five words. **Introduction** is about 400-600 words, covering the background and aims of the research. **Materials and Methods** should emphasize on the procedures and data analysis. **Results and Discussion** should be written as a series of connecting sentences, however, for manuscript with long discussion should be divided into subtitles. Thorough discussion represents the causal effect mainly explains for why and how the results of the research were taken place, and do not only re-express the mentioned results in the form of sentences. **Concluding** sentence should be given at the end of the discussion. **Acknowledgments** are expressed in a brief; all sources of institutional, private and corporate financial support for the work must be fully acknowledged, and any potential conflicts of interest are noted.

**Figures and Tables** of maximum of three pages should be clearly presented. Title of a picture is written down below the picture, while title of a table is written above the table. Colored figures can only be accepted if the information in the manuscript can lose without those images; chart is preferred to use black and white images. Author could consign any picture or photo for the front cover, although it does not print in the manuscript. All images property of others should be mentioned source. **There is no appendix**, all data or data analysis are incorporated into Results and Discussions. For broad data, it can be displayed on the website as a supplement.

**References** Author-year citations are required. In the text give the authors name followed by the year of publication and arrange from oldest to newest and from A to Z. In citing an article written by two authors, both of them should be mentioned, however, for three and more authors only the first author is mentioned followed by et al., for example: Saharjo and Nurhayati (2006) or (Boonkerd 2003a, b, c; Sugiyarto 2004; El-Bana and Nijs 2005; Balagadde et al. 2008; Webb et al. 2008). Extent citation as shown with word "cit" should be avoided. Reference to unpublished data and personal communication should not appear in the list but should be cited in the text only (e.g., Rifai MA 2007, pers. com. (personal communication); Setyawan AD 2007, unpublished data). In the reference list, the references should be listed in an alphabetical order (better, if only 20 for research papers). Names of journals should be abbreviated. Always use the standard abbreviation of a journal's name according to the **ISSN List of Title Word Abbreviations** ([www.issn.org/2-22661-LTWA-online.php](http://www.issn.org/2-22661-LTWA-online.php)). The following examples are for guidance.

### Journal:

Saharjo BH, Nurhayati AD. 2006. Domination and composition structure change at hemic peat natural regeneration following burning; a case study in Pelalawan, Riau Province. *Biodiversitas* 7: 154-158.

### Book:

Rai MK, Carpinella C. 2006. Naturally Occurring Bioactive Compounds. Elsevier, Amsterdam.

### Chapter in book:

Webb CO, Cannon CH, Davies SJ. 2008. Ecological organization, biogeography, and the phylogenetic structure of rainforest tree communities. In: Carson W, Schnitzer S (eds) *Tropical Forest Community Ecology*. Wiley-Blackwell, New York.

### Abstract:

Assaad AM. 2007. Seed production and dispersal of *Rhazya stricta*. 50<sup>th</sup> annual symposium of the International Association for Vegetation Science, Swansea, UK, 23-27 July 2007.

### Proceeding:

Alikodra HS. 2000. Biodiversity for development of local autonomous government. In: Setyawan AD, Sutarno (eds.) *Toward Mount Lawu National Park; Proceeding of National Seminary and Workshop on Biodiversity Conservation to Protect and Save Germplasm in Java Island*. Universitas Sebelas Maret, Surakarta, 17-20 July 2000. [Indonesian]

### Thesis, Dissertation:

Sugiyarto. 2004. Soil Macro-invertebrates Diversity and Inter-Cropping Plants Productivity in Agroforestry System based on Sengon. [Dissertation]. Universitas Brawijaya, Malang. [Indonesian]

### Information from internet:

Balagadde FK, Song H, Ozaki J, Collins CH, Barnet M, Arnold FH, Quake SR, You L. 2008. A synthetic *Escherichia coli* predator-prey ecosystem. *Mol Syst Biol* 4: 187. [www.molecularsystemsbiology.com](http://www.molecularsystemsbiology.com)

**THIS PAGE INTENTIONALLY LEFT BLANK**

# Current Issue



(<https://smujo.id/biodiv/issue/view/284>)

Vol. 21 No. 12 (2020)

[View All Issues ➤ \(https://smujo.id/biodiv/issue/archive\)](https://smujo.id/biodiv/issue/archive)

**Online** [biodiversitas.mipa.uns.ac.id](https://biodiversitas.mipa.uns.ac.id), [smujo.id/biodiv](https://smujo.id/biodiv) (<https://smujo.id/biodiv/>)

**ISSN:** 1412-033X, **E-ISSN:** 2085-4722

**Publisher:** Society for Indonesian Biodiversity

**Co-publisher:** Department of Biology, FMNS, Universitas Sebelas Maret Surakarta

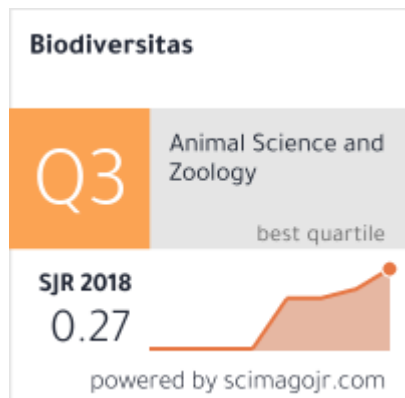
**First Publication:** 2000

**Period of issuance:** Starting on January 1, 2019, Biodiversitas will be issued monthly

**Aims and Scope** *Biodiversitas, Journal of Biological Diversity* or abbreviated as *Biodiversitas* encourages submission of manuscripts dealing with all biodiversity aspects of plants, animals and microbes at the level of the gene, species, and ecosystem as well as ethnobiology.

**Article types** The journal seeks original full-length research papers, reviews, and short communication. Manuscript of original research should be written in no more than 8,000 words (including tables and picture), or proportional with articles in this publication number. Review articles will be accommodated, while, short communication should be written at least 2,000 words, except for pre-study.

**Indexing** The journal has been indexed/registered in SCOPUS, DOAJ, Google Scholar, Crossref, EBSCO, Microsoft Academic Search, etc.



([https://www.scimagojr.com/journalsearch.php?](https://www.scimagojr.com/journalsearch.php?q=21100332431&tip=sid&clean=0)

[q=21100332431&tip=sid&clean=0](https://www.scimagojr.com/journalsearch.php?q=21100332431&tip=sid&clean=0))

#### Information

For Readers (<https://smujo.id/biodiv/information/readers>)

For Authors (<https://smujo.id/biodiv/information/authors>)

For Librarians (<https://smujo.id/biodiv/information/librarians>)

#### Usage Statistics Information

We log anonymous usage statistics. Please read the privacy information (<https://smujo.id/biodiv/usageStats/privacyInformation>) for details.

#### Journals List

Biodiversitas Journal of Biological Diversity (<https://smujo.id/biodiv>)

Nusantara Bioscience (<https://smujo.id/nb>)

Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia (<https://smujo.id/psnmbi>)

Asian Journal of Agriculture (<https://smujo.id/aja>)

Asian Journal of Ethnobiology (<https://smujo.id/aje>)

Asian Journal of Forestry (<https://smujo.id/ajf>)

Biofarmasi Journal of Natural Product Biochemistry (<https://smujo.id/jnpb>)

Bioteknologi Biotechnological Studies (<https://smujo.id/bbs>)



Bonorowo Wetlands (<https://smujo.id/bw>)

Cell Biology and Development (<https://smujo.id/cbd>)

Ocean Life (<https://smujo.id/ol>)

Tropical Drylands (<https://smujo.id/td>)

Reviewers List

Reviewers (<https://smujo.id/biodiv/reviewers/index>)

Visitor Statistics

Statistics (<https://smujo.id/info/stats>)



(<https://info.flagcounter.com/JKar>)



(<https://www.scopus.com/sourceid/21100332431>)



(<http://doaj.org/toc/3eda1e70aa014e1e8bd1fc367b4df956>)



(<http://scholar.google.co.id/citations?hl=id&user=rae-lrEAAAJ>)



(<http://search.crossref.org/?q=biodiversitas&type=Journal>)



(<https://academic.microsoft.com/#/detail/2738269101>)

# About the Society

Society for Indonesian Biodiversity (SIB) or Masyarakat Biodiversitas Indonesia (MBI) is an organization that engaged in the sphere of research, conservation and use of biodiversity in a sustainable manner at the level of genes, species, ecosystems, and cultural utilization (ethnobiology). SIB was founded in Surakarta, Indonesia on July 17, 2006. The nature of SIB membership is valid for lifetime. Prospective members must approve SIB Bylaw (AD/ART MBI) and pay a membership fee of IDR 200, 000 (USD 15) per year. Full payment for the 5, 10 or 20 years (lifetime) get a rebate of 25%. Members get a sample of the journal "Biodiversitas" and "Nusantara Bioscience" print edition and/or online and get privileges and rebates for activities organized by the central Board of SIB.

Download SIB Bylaw (AD/ART MBI) here. (<http://biodiversitas.mipa.uns.ac.id/M/archives/adart.pdf>)

The following is a link SIB membership registration form.

Download membership application form here.

(<http://biodiversitas.mipa.uns.ac.id/D/membershipform.doc>)

Submit a membership application form and photograph by email to the following address: [unsjournals@gmail.com](mailto:unsjournals@gmail.com) (<mailto:unsjournals@gmail.com>)

Or may also register online at the following link: <http://goo.gl/forms/Pb7B1vJy0P>  
(<http://goo.gl/forms/Pb7B1vJy0P>)

## Information

For Readers (<https://smujo.id/biodiv/information/readers>)

For Authors (<https://smujo.id/biodiv/information/authors>)

For Librarians (<https://smujo.id/biodiv/information/librarians>)

## Usage Statistics Information

We log anonymous usage statistics. Please read the privacy information (<https://smujo.id/biodiv/usageStats/privacyInformation>) for details.

## Journals List

Biodiversitas Journal of Biological Diversity (<https://smujo.id/biodiv>)

Nusantara Bioscience (<https://smujo.id/nb>)

Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia (<https://smujo.id/psnmbi>)

Asian Journal of Agriculture (<https://smujo.id/aja>)



Asian Journal of Ethnobiology (<https://smujo.id/aje>)

Asian Journal of Forestry (<https://smujo.id/ajf>)

Biofarmasi Journal of Natural Product Biochemistry (<https://smujo.id/jnpb>)

Bioteknologi Biotechnological Studies (<https://smujo.id/bbs>)

Bonorowo Wetlands (<https://smujo.id/bw>)

Cell Biology and Development (<https://smujo.id/cbd>)

Ocean Life (<https://smujo.id/ol>)

Tropical Drylands (<https://smujo.id/td>)

Reviewers List

Reviewers (<https://smujo.id/biodiv/reviewers/index>)

Visitor Statistics

Statistics (<https://smujo.id/info/stats>)



(<https://info.flagcounter.com/JKar>)



(<https://www.scopus.com/sourceid/21100332431>)

(<http://doaj.org/toc/3eda1e70aa014e1e8bd1fc367b4df956>)

(<http://scholar.google.co.id/citations?hl=id&user=rae-lrEAAAAJ>)



(<http://search.crossref.org/?q=biodiversitas&type=Journal>)



(<https://academic.microsoft.com/#/detail/2738269101>)

# Editorial Team

## EDITOR-IN-CHIEF:

Sutarno (<https://www.scopus.com/authid/detail.uri?authorId=36940489100>)

## EDITORIAL MEMBERS:

English Editors: Graham Eagleton ([grahameagleton@gmail.com](mailto:grahameagleton@gmail.com))

English Editors: Suranto (<http://scholar.google.co.id/citations?user=M7F6OFvtsIIC&hl=zh-TW>) ([surantouns@gmail.com](mailto:surantouns@gmail.com))

Technical Editors: Solichatun ([solichatun\\_s@yahoo.com](mailto:solichatun_s@yahoo.com))

Technical Editors: Artini Pangastuti (<https://www.scopus.com/authid/detail.uri?authorId=56499336500>) ([pangastuti\\_tutut@yahoo.co.id](mailto:pangastuti_tutut@yahoo.co.id))

Distribution & Marketing: Rita Rakhmawati ([oktia@yahoo.com](mailto:oktia@yahoo.com))

Webmaster: Ari Pitoyo (<https://www.scopus.com/authid/detail.uri?authorId=56868648100>) ([aripitoyo@yahoo.co.id](mailto:aripitoyo@yahoo.co.id))

## MANAGING EDITOR:

Ahmad Dwi Setyawan (<https://www.scopus.com/authid/detail.uri?authorId=56499036300>) ([unsjournals@gmail.com](mailto:unsjournals@gmail.com))

## EDITORIAL BOARD:

Abd Fattah N. Abd Rabou (<http://scholar.google.co.id/citations?user=PWxjW9QAAAAJ&hl=zh-TW>), Islamic University of Gaza, Palestine

Agnieszka B. Najda (<http://www.scopus.com/authid/detail.uri?authorId=56003169600>), University of Life Sciences in Lublin, Lublin, Poland

Ajay Kumar Gautam (<https://www.scopus.com/authid/detail.uri?authorId=36140953200>), Abhilashi University Mandi, Himachal Pradesh, India

Alan J. Lymbery (<http://www.scopus.com/authid/detail.url?authorId=7005135616>), Murdoch University, Perth, Australia

Bambang Hero Saharjo (<http://www.scopus.com/authid/detail.url?authorId=6602390007>), Institut Pertanian Bogor, Bogor, Indonesia

Daiane H. Nunes (<http://www.scopus.com/authid/detail.url?authorId=15122716800>), State University of Londrina, Londrina, Brazil

Darlina Md. Naim (<https://www.scopus.com/authid/detail.uri?authorId=26531487400>), University Sains Malaysia, Penang, Malaysia

Ghulam Hassan Dar (<http://www.scopus.com/authid/detail.url?authorId=6701564532>), Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, India

Hassan Pourbabaie (<http://www.scopus.com/authid/detail.url?authorId=14013797600>), University of Guilan, Somehsara, Guilan, Iran

Joko Ridho Witono (<http://www.scopus.com/authid/detail.url?authorId=19436718100>), Center for Plant Conservation-Bogor Botanical Gardens, Indonesian Institute of Sciences, Bogor, Indonesia

Kartika Dewi (<https://www.scopus.com/authid/detail.uri?authorId=57212012417>), Research Center for Biology, Indonesian Institute of Sciences, Cibinong, Bogor, Indonesia

Katsuhiko Kondo (<http://www.scopus.com/authid/detail.url?authorId=55565843700>), University of Missouri, Columbia, USA

Kusumadewi Sri Yulita (<https://www.scopus.com/authid/detail.uri?authorId=10938890500>), Research Center for Biology, Indonesian Institute of Sciences, Cibinong, Bogor, Indonesia

Livia Wanntorp (<http://www.scopus.com/authid/detail.url?authorId=6602639027>), Naturhistoriska riksmuseet, Stockholm, Sweden

M. Jayakara Bhandary (<http://www.scopus.com/authid/detail.url?authorId=6507689393>), Government Arts and Science College, Karwar, Karnataka, India

Mahdi Reyahi-Khoram (<https://www.scopus.com/authid/detail.uri?authorId=15132478500>), Islamic Azad University (Hamadan Branch), Hamadan, Iran

Mahendra Kumar Rai (<http://www.scopus.com/authid/detail.url?authorId=35494108800>), SGB Amravati University, Maharashtra, India

Mahesh K. Adhikari (<http://www.scopus.com/authid/detail.url?authorId=56082171700>), Adhikari Niwas, Kathmandu, Nepal

Maria Panitsa (<https://www.scopus.com/authid/detail.uri?authorId=6506787287>), University of Patras, Agrinio, Greece

Mochamad A. Soendjoto (<http://pin.primate.wisc.edu/idp/wdp/entry/4689>), Lambung Mangkurat University, Banjarbaru, Indonesia

Mohamed M.M. Najim (<https://www.scopus.com/authid/detail.uri?authorId=7004047112>), University of Kelaniya, Kelaniya, Sri Lanka

Mohib A. Shah (<http://www.scopus.com/authid/detail.url?authorId=46661953800>), Nepean Telehealth Technology Centre, Sydney, Australia

Praptiwi (<https://www.scopus.com/authid/detail.uri?authorId=57196436064>), Research Center for Biology, Indonesian Institute of Sciences, Cibinong, Bogor, Indonesia

Rasool B.Tareen (<http://www.scopus.com/authid/detail.url?authorId=6602826587>), University of Balochistan, Quetta, Pakistan

Seyed Aliakbar Hedayati (<https://www.scopus.com/authid/detail.uri?authorId=35226481400>), Gorgan University of Agricultural Sciences and Natural Resources, Iran

Seyed Mehdi Talebi (<https://www.scopus.com/authid/detail.uri?authorId=36544483000>), Arak University, Iran

Shahabuddin (<http://www.scopus.com/authid/detail.url?authorId=8138666500>), Universitas Tadulako, Palu, Indonesia

Shahir Shamsir (<https://www.scopus.com/authid/detail.uri?authorId=8265592000>), Universiti Teknologi Malaysia, Skudai, Malaysia

Shri Kant Tripathi, (<https://www.scopus.com/authid/detail.uri?authorId=7202858879>) Mizoram University, Aizawl, India

Sugeng Budiharta (<https://www.scopus.com/authid/detail.uri?authorId=53871032400>), Purwodadi Botanical Gardens, Indonesian Institute of Sciences, Pasuruan, Indonesia

Sugiyarto (<http://scholar.google.co.id/citations?user=EiDmH1YAAAAJ&hl=id&cstart=0&pagesize=20>), Universitas Sebelas Maret, Surakarta, Central Java, Indonesia

Subash C. Santra (<https://www.scopus.com/authid/detail.uri?authorId=7006693521>), University of Kalyani, India

Taufiq Purna Nugraha (<https://www.scopus.com/authid/detail.uri?authorId=57191611489>), Research Center for Biology, Indonesian Institute of Sciences, Cibinong, Bogor, Indonesia

#### Information

For Readers (<https://smujo.id/biodiv/information/readers>)

For Authors (<https://smujo.id/biodiv/information/authors>)

For Librarians (<https://smujo.id/biodiv/information/librarians>)

#### Usage Statistics Information

We log anonymous usage statistics. Please read the privacy information (<https://smujo.id/biodiv/usageStats/privacyInformation>) for details.

#### Journals List

Biodiversitas Journal of Biological Diversity (<https://smujo.id/biodiv>)

Nusantara Bioscience (<https://smujo.id/nb>)

Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia (<https://smujo.id/psnmbi>)

Asian Journal of Agriculture (<https://smujo.id/aja>)

Asian Journal of Ethnobiology (<https://smujo.id/aje>)

Asian Journal of Forestry (<https://smujo.id/ajf>)

Biofarmasi Journal of Natural Product Biochemistry (<https://smujo.id/jnpb>)

Bioteknologi Biotechnological Studies (<https://smujo.id/bbs>)

Bonorowo Wetlands (<https://smujo.id/bw>)

Cell Biology and Development (<https://smujo.id/cbd>)

Ocean Life (<https://smujo.id/ol>)

Tropical Drylands (<https://smujo.id/td>)

Reviewers List

Reviewers (<https://smujo.id/biodiv/reviewers/index>)

Visitor Statistics

Statistics (<https://smujo.id/info/stats>)

#### Visitors

	265,021		5,059
	16,214		4,816
	10,480		3,820
	7,485		2,866
	5,407		2,444

 **FLAG** counter

(<https://info.flagcounter.com/JKar>)



(<https://www.scopus.com/sourceid/21100332431>)

(<http://doaj.org/toc/3eda1e70aa014e1e8bd1fc367b4df956>)



(<http://scholar.google.co.id/citations?hl=id&user=rae-lrEAAAJ>)



(<http://search.crossref.org/?q=biodiversitas&type=Journal>)



(<https://academic.microsoft.com/#/detail/2738269101>)

# Contact

Please contact the contact below if you experience problems.

## Principal Contact

Ahmad Dwi Setyawan

[editors@smujo.id](mailto:editors@smujo.id) (<mailto:editors@smujo.id>)

## Support Contact

Support

[support@smujo.id](mailto:support@smujo.id) (<mailto:support@smujo.id>)

### Information

[For Readers \(https://smujo.id/biodiv/information/readers\)](https://smujo.id/biodiv/information/readers)

[For Authors \(https://smujo.id/biodiv/information/authors\)](https://smujo.id/biodiv/information/authors)

[For Librarians \(https://smujo.id/biodiv/information/librarians\)](https://smujo.id/biodiv/information/librarians)

### Usage Statistics Information

We log anonymous usage statistics. Please read the privacy information (<https://smujo.id/biodiv/usageStats/privacyInformation>) for details.

### Journals List

[Biodiversitas Journal of Biological Diversity \(https://smujo.id/biodiv\)](https://smujo.id/biodiv)

[Nusantara Bioscience \(https://smujo.id/nb\)](https://smujo.id/nb)

[Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia \(https://smujo.id/psnmbi\)](https://smujo.id/psnmbi)

[Asian Journal of Agriculture \(https://smujo.id/aja\)](https://smujo.id/aja)

[Asian Journal of Ethnobiology \(https://smujo.id/aje\)](https://smujo.id/aje)

[Asian Journal of Forestry \(https://smujo.id/ajf\)](https://smujo.id/ajf)

[Biofarmasi Journal of Natural Product Biochemistry \(https://smujo.id/jnpb\)](https://smujo.id/jnpb)

[Bioteknologi Biotechnological Studies \(https://smujo.id/bbs\)](https://smujo.id/bbs)

Bonorowo Wetlands (<https://smujo.id/bw>)

Cell Biology and Development (<https://smujo.id/cbd>)

Ocean Life (<https://smujo.id/ol>)

Tropical Drylands (<https://smujo.id/td>)

Reviewers List

Reviewers (<https://smujo.id/biodiv/reviewers/index>)

Visitor Statistics

Statistics (<https://smujo.id/info/stats>)



(<https://info.flagcounter.com/JKar>)



(<https://www.scopus.com/sourceid/21100332431>)

(<http://doaj.org/toc/3eda1e70aa014e1e8bd1fc367b4df956>)



(<http://scholar.google.co.id/citations?hl=id&user=rae-lrEAAAAJ>)



(<http://search.crossref.org/?q=biodiversitas&type=Journal>)



(<https://academic.microsoft.com/#/detail/2738269101>)





(<https://smujo.id/biodiv/issue/view/276>)

Vol. 21 No. 10 (2020)

## Full Issue

Front Cover (<https://smujo.id/biodiv/issue/view/276/131>)

## Articles

Ethnobotanical investigation of spice and condiment plants used by the Taming tribe in Aceh, Indonesia

(<https://smujo.id/biodiv/article/view/6380>)

ZIDNI ILMAN NAVIA, DITA AUDIRA, NURUL AFIFAH, KASANOVA TURNIP, NURAINI, ADI BEJO SUWARDI

PDF (<https://smujo.id/biodiv/article/view/6380/4245>)

Daily activity, diet and habitat of Bali myna (*Leucopsar rothschildi*) in Nusa Penida, Bali, Indonesia (<https://smujo.id/biodiv/article/view/6472>)

FRANSISCUS XAVERIUS SUDARYANTO, SATYAWAN PUDYATMOKO, TJUT  
SUGANDAWATY DJOHAN, JUSUP SUBAGJA, I WAYAN SUANA, LALU ACHMAD TAN  
TILAR WANGSAJATI SUKMARING KALIH, JUNITA HARDINI, JOBNICO SUBAGIO

PDF (<https://smujo.id/biodiv/article/view/6472/4247>)

Culturable gut bacteria of Ikan Batak (*Neolissochilus sumatranus* Weber  
& de Beaufort, 1916) collected in Toba Samosir, Indonesia  
(<https://smujo.id/biodiv/article/view/6481>)

ACHMAD DINOTO, RINI HANDAYANI, NINU SETIANINGRUM, HEDDY JULISTIONO

PDF (<https://smujo.id/biodiv/article/view/6481/4248>)

A synopsis of Bambusoideae (Poaceae) in Lombok, Indonesia  
(<https://smujo.id/biodiv/article/view/6637>)

I PUTU GEDE P. DAMAYANTO, HIMMAH RUSTIAMI, MIFTAHUDIN, TATIK CHIKMAWATI

PDF (<https://smujo.id/biodiv/article/view/6637/4249>)

Selection of stain fungi on rubberwood (*Hevea brasiliensis*) and its growth  
response against chitosan (<https://smujo.id/biodiv/article/view/6525>)

ALI BIN ABITHALIB SALMAN, LISDAR IDWAN SUDIRMAN, DODI NANDIKA

PDF (<https://smujo.id/biodiv/article/view/6525/4250>)

Short Communication: Herpetofauna diversity at the University of  
Palangka Raya, Indonesia (<https://smujo.id/biodiv/article/view/6283>)

ANDRI MAULIDI, TITIN PURNANINGSIH, ANITA MAULINA, YOHANES EDY GUNAWAN,  
MUHAMMAD RIZKI

PDF (<https://smujo.id/biodiv/article/view/6283/4251>)

Diet composition and neighboring prey community of the Phuping newt  
(*Tylototriton uyeno*) in Maesa-Kogma Biosphere Reserve, Chiang Mai  
Province, northern Thailand (<https://smujo.id/biodiv/article/view/6346>)

THANSUDA DOWWANGKAN, YODCHAIY CHUAYNKERN, PONGRAT  
DUMRONGROJWATTANA, PRATEEP DUENGKAE

PDF (<https://smujo.id/biodiv/article/view/6346/4252>)

Short Communication: Effect of cryopreservation on ultrastructure and  
mitochondrial function of albino *Pangasius catfish* spermatozoa  
(<https://smujo.id/biodiv/article/view/6544>)

USWATUN HASANAH, ABINAWANTO, A. ALIMUDDIN, ARIEF BOEDIONO, ENI KUSRINI

PDF (<https://smujo.id/biodiv/article/view/6544/4253>)

The practice and plants used in Besale ritual healing by the Anak Dalam Tribe in Nyogan Village, Jambi, Indonesia  
(<https://smujo.id/biodiv/article/view/6028>)

REVIS ASRA, MARINA SILALAH, IZU ANDRY FIJRIDIYANTO

PDF (<https://smujo.id/biodiv/article/view/6028/4254>)

Resistance level of several soybean lines of M6 generation to stem rot disease *Athelia rolfsii* (<https://smujo.id/biodiv/article/view/6243>)

DIANA SOFIA HANAFIAH, IRDA SAFNI, LUTHFI A.M. SIREGAR, REVANDY I.M. DAMANIK, ANGGRIA LESTAMI, MIKA MATONDANG

PDF (<https://smujo.id/biodiv/article/view/6243/4255>)

Response of parasitoids to invasive pest *Phenacoccus manihoti* Matile-Ferrero (Hemiptera: Pseudococcidae) on cassava crop in Bali, Indonesia  
(<https://smujo.id/biodiv/article/view/6319>)

I WAYAN SUPARTHA, I KADEK WISMA YUDHA, PUTU ANGGA WIRADANA, I WAYAN SUSILA

PDF (<https://smujo.id/biodiv/article/view/6319/4337>)

Phenotypic plasticity of eddoe and dasheen taro genotypes in response to saturated water and dryland cultivations  
(<https://smujo.id/biodiv/article/view/6489>)

CARECA SEPDIHAN RAHMAT HIDAYATULLAH, EDI SANTOSA, DIDY SOPANDIE, ARIEF HARTONO

PDF (<https://smujo.id/biodiv/article/view/6489/4258>)

Seed germination characteristics in different storage time of *Gmelina arborea* treated with ultrafine bubbles priming  
(<https://smujo.id/biodiv/article/view/6677>)

ISKANDAR Z. SIREGAR, KARIMA FAUZIAH MUHARAM, Y. ARIS PURWANTO, DEDE J. SUDRAJAT

PDF (<https://smujo.id/biodiv/article/view/6677/4259>)

Genetic structure of the *Capoeta aculeata* populations inferred from microsatellite DNA loci (<https://smujo.id/biodiv/article/view/6261>)

HABIBOLLAH GANDOMKAR, SEYED PEZHMAN HOSSEINI SHEKARABI, HOSSEIN ALI ABDOLHAY, SAJAD NAZARI, MEHDI SHAMSAEI MEHRJAN

PDF (<https://smujo.id/biodiv/article/view/6261/4260>)

Morphometric and genetic variations of species composers of nike fish assemblages in Gorontalo Bay Waters, Indonesia  
(<https://smujo.id/biodiv/article/view/6414>)

FEMY M. SAHAMI, RENE CHARLES KEPEL, ABDUL HAFIDZ OLII, SILVESTER BENNY PRATASIK, RIDWAN LASABUDA, ADNAN WANTASEN, SITTY AINSYAH HABIBIE

PDF (<https://smujo.id/biodiv/article/view/6414/4261>)

Heavy metals contaminants in the eggs and temperatures of nesting beaches of sea turtles in Kaimana, West Papua, Indonesia  
(<https://smujo.id/biodiv/article/view/6556>)

RICARDO F. TAPILATU, HENGKI WONA, RIMA HS. SIBURIAN, SEFRIANTO T. SALEDA

PDF (<https://smujo.id/biodiv/article/view/6556/4262>)

The quality of fermented goat milk produced by *Pediococcus acidilactici* BK01 on refrigerator temperature  
(<https://smujo.id/biodiv/article/view/6565>)

SRI MELIA, INDRI JULIYARSI, YULIANTI FITRI KURNIA, YUDHA ENDRA PRATAMA, DHIVA REZZY PRATAMA

PDF (<https://smujo.id/biodiv/article/view/6565/4263>)

Ethnomedicinal plants and practices related to pregnancy, childbirth, and postpartum healthcare of Minangkabau ethnic group, West Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/6461>)

MARINA SILALAH, ARDIAN KHAIRIAH, NISYAWATI NISYAWATI

PDF (<https://smujo.id/biodiv/article/view/6461/4267>)

Benthic macrofaunal assemblage in seagrass-mangrove complex and adjacent ecosystems of Punang-Sari Estuary, Lawas, Sarawak, Malaysia  
(<https://smujo.id/biodiv/article/view/6548>)

ABDULLA AL-ASIF, HADI HAML, ABU HENA MUSTAFA KAMAL, MOHD HANAFI IDRIS, GEOFFERY JAMES GERUSU, JOHAN BIN ISMAIL, NURUL ULFAH KARIM

PDF (<https://smujo.id/biodiv/article/view/6548/4268>)

Chemical compounds contained in young and mature leaves of agarwood species *Wikstroemia tenuiramis* and its antioxidant properties  
(<https://smujo.id/biodiv/article/view/6547>)

RIDWANTI BATUBARA, TENGKU ISMANELLY HANUM, ODING AFFANDI, HENNY SRI

PDF (<https://smujo.id/biodiv/article/view/6547/4269>)

Diversity and honey properties of stingless bees from meliponiculture in East and North Kalimantan, Indonesia (<https://smujo.id/biodiv/article/view/6079>)

SYAFRIZAL, RICO RAMADHAN, IRAWAN WIJAYA KUSUMA, SAAT EGRA, KUNIYOSHI SHIMIZU, MAMORU KANZAKI, ENOS TANGKE ARUNG

PDF (<https://smujo.id/biodiv/article/view/6079/4270>)

Short Communication: Pattern of antibiotic resistance on extended-spectrum beta-lactamases genes producing *Escherichia coli* on laying hens in Blitar, Indonesia (<https://smujo.id/biodiv/article/view/6483>)

FRESHINTA JELLIA WIBISONO, BAMBANG SUMIARTO, TRI UNTARI, MUSTOFA HELMI EFFENDI, DIAN AYU PERMATASARI, ADIANA MUTAMSARI WITANINGRUM

PDF (<https://smujo.id/biodiv/article/view/6483/4271>)

Diversity and distribution of mollusks at three zones of mangrove in Pejarakan, Bali, Indonesia (<https://smujo.id/biodiv/article/view/6618>)

I KETUT GINANTRA, I KETUT MUKSIN, IDA BAGUS MADE SUASKARA, MARTIN JONI

PDF (<https://smujo.id/biodiv/article/view/6618/4272>)

Detection and prevalence of multidrug-resistant *Klebsiella pneumoniae* strains isolated from poultry farms in Blitar, Indonesia (<https://smujo.id/biodiv/article/view/6696>)

DIAN AYU PERMATASARI, ADIANA MUTAMSARI WITANINGRUM, FRESHINTA JELLIA WIBISONO, MUSTOFA HELMI EFFENDI

PDF (<https://smujo.id/biodiv/article/view/6696/4273>)

The ecology of *Aedes aegypti* and *Aedes albopictus* larvae habitat in coastal areas of South Sulawesi, Indonesia (<https://smujo.id/biodiv/article/view/6491>)

ARINI RATNASARI, ARIF RAHMAN JABAL, NUR RAHMA, SRI NUR RAHMI, MILA KARMILA, ISRA WAHID

PDF (<https://smujo.id/biodiv/article/view/6491/4274>)

Changes in microbial populations during co-composting of dewatered sewage sludge with pruning wastes in windrow piles (<https://smujo.id/biodiv/article/view/6466>)

AMIR HOSSEIN NAFEZ, MAHNAZ NIKAEEN, AKBAR HASSANZADEH, SAFOORA KADKHODAEI

PDF (<https://smujo.id/biodiv/article/view/6466/4276>)

Maximum entropy modeling for the conservation of *Hopea odorata* in riparian forests, central Thailand  
(<https://smujo.id/biodiv/article/view/6320>)

LAMTHAI ASANOK, TORLARP KAMYO, DOKRAK MAROD

PDF (<https://smujo.id/biodiv/article/view/6320/4277>)

Short Communication: Variations of morphology, anatomy, and metabolite profiles of *Citrus reticulata* Blanco cv. Tawangmangu grafts produced by shoot tip grafting using several rootstocks  
(<https://smujo.id/biodiv/article/view/6648>)

EINSTIVINA NURYANDANI, RATNA SUSANDARINI, SITI SUBANDIYAH

PDF (<https://smujo.id/biodiv/article/view/6648/4278>)

The use of effector gene based-markers to facilitate identification of *Fusarium* sp. infected shallot in Java, Indonesia  
(<https://smujo.id/biodiv/article/view/6699>)

LINA HERLINA, BONJOK ISTIAJI

PDF (<https://smujo.id/biodiv/article/view/6699/4279>)

Biology, morphology and damage of the lesser Coconut weevil, *Diocalandra frumenti* (Coleoptera: Curculionidae) in southern Vietnam  
(<https://smujo.id/biodiv/article/view/6421>)

HONG-UNG NGUYEN, THI-HIEN NGUYEN, NGUYEN-QUOC-KHANH CHAU, VAN-VANG LE, VAN-HAI TRAN

PDF (<https://smujo.id/biodiv/article/view/6421/4280>)

The effectiveness of silvofishery system in water treatment in intensive whiteleg shrimp (*Litopenaeus vannamei*) ponds, Probolinggo District, East Java, Indonesia (<https://smujo.id/biodiv/article/view/6412>)

MUHAMMAD MUSA, EVELLIN DEWI LUSIANA, NANIK RETNO BUWONO, SULASTRI ARSAD, MOHAMMAD MAHMUDI

PDF (<https://smujo.id/biodiv/article/view/6412/4283>)

Consortium of endophytic bacteria and rhizobacteria effectively suppresses the population of *Pratylenchus coffeae* and promotes the growth of Robusta coffee (<https://smujo.id/biodiv/article/view/6529>)

IIS NUR ASYIAH, IMAM MUDAKIR, MOHAMMAD HOESAIN, ANKARDIANSYAH PANDU PRADANA, ACHMAD DJUNAIDY, RIZA FAHLEVIA SARI

PDF (<https://smujo.id/biodiv/article/view/6529/4282>)

Short Communication: Genetic variation of *Coelogyne pandurate*, *C. rumphii* and their hybrids based on RAPD markers (<https://smujo.id/biodiv/article/view/5987>)

SRI HARTATI, ENDANG S. MULIAWATI

PDF (<https://smujo.id/biodiv/article/view/5987/4284>)

Short Communication: The physical and chemical properties of nipah (*Nypa fructicans*) frond as an alternative feed for ruminants in Indonesia (<https://smujo.id/biodiv/article/view/6479>)

MUHAMMAD AFDAL, TEJA KASWARI, SAITUL FAKHRI, HENI SURYANI

PDF (<https://smujo.id/biodiv/article/view/6479/4285>)

Molecular identification of cellulase and protease producing *Bacillus tequilensis* UTMSA14 isolated from the geothermal hot spring in Lau Sidebuk Debuk, North Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/6476>)

EDY FACHRIAL, RADEN RORO JENNY SATYO PUTRI, I NYOMAN EHRICH LISTER, SARI ANGGRAINI, HARMILENI, TITANIA T. NUGROHO, SARYONO

PDF (<https://smujo.id/biodiv/article/view/6476/4287>)

Isolation and characterization of lactic acid bacteria from fecal pellets, coelomic fluid, and gastrointestinal tract of *Nypa* worm (*Namalycastis rhodochorde*) from West Kalimantan, Indonesia (<https://smujo.id/biodiv/article/view/6022>)

ARI HEPI YANTI, TRI RIMA SETYAWATI, RIKHSAN KURNIATUHADI

PDF (<https://smujo.id/biodiv/article/view/6022/4288>)

Metabolic profile and skin-related bioactivities of *Cerioporus squamosus* hydromethanolic extract (<https://smujo.id/biodiv/article/view/6388>)

WAILL A. ELKHATEEB, GHOSON M. DABA, MARWA O. ELNAHAS, PAUL W. THOMAS, MAHMOUD EMAM

PDF (<https://smujo.id/biodiv/article/view/6388/4289>)

Hematological and antioxidants responses of dairy cow fed with a combination of feed and duckweed (*Lemna minor*) as a mixture for improving milk biosynthesis (<https://smujo.id/biodiv/article/view/6478>)



UJANG HIDAYAT TANUWIRIA, ANDI MUSHAWWIR

PDF (<https://smujo.id/biodiv/article/view/6478/4291>)

The production function and profitability analysis of *Gracilaria* sp. seaweed polyculture with milkfish (*Chanos chanos*) and black tiger shrimp (*Penaeus monodon*) (<https://smujo.id/biodiv/article/view/6122>)

IIS DIATIN, IRZAL EFFENDI, MERI ALVINA TAUFIK

PDF (<https://smujo.id/biodiv/article/view/6122/4290>)

Pharmacognostic, chemical and mucolytic activity study of *Malva pseudolavatera* Webb & Berthel. and *Malva sylvestris* L. (Malvaceae) leaf extracts, grown in Ecuador (<https://smujo.id/biodiv/article/view/6642>)

MIGDALIA MIRANDA-MARTÍNEZ, GLENDA MARCELA SARMIENTO-TOMALÁ, IVÁN ANDRÉS CHÓEZ-GUARANDA, YAMILET IRENE GUTIÉRREZ-GAITÉN, RENÉ DELGADO-HERNÁNDEZ, GABRIELA CARRILLO-LAVID

PDF (<https://smujo.id/biodiv/article/view/6642/4293>)

Thermostability, photostability, and toxicity of clove oil nanoparticles against *Cryptolestes ferrugineus* (Stephens) (Coleoptera: Laemophloeidae) (<https://smujo.id/biodiv/article/view/6720>)

SILVI IKAWATI, TOTO HIMAWAN, ABDUL LATIEF ABADI, HAGUS TARNO

PDF (<https://smujo.id/biodiv/article/view/6720/4294>)

Low genetic diversity and no genetic differentiation between maleo hatched at coastal and inland nesting grounds in North Sulawesi, Indonesia (<https://smujo.id/biodiv/article/view/6188>)

ANDIE WIJAYA SAPUTRA, PRAMANA YUDA

PDF (<https://smujo.id/biodiv/article/view/6188/4295>)

Profiling indigenous lead-reducing bacteria from Tempe Lake, South Sulawesi, Indonesia as bioremediation agents (<https://smujo.id/biodiv/article/view/6373>)

AHMAD YANI, MOHAMAD AMIN, FATCHUR ROHMAN, ENDANG SUARSINI, WIRA EKA PUTRA

PDF (<https://smujo.id/biodiv/article/view/6373/4296>)

The application of novel methods of Animal Barrier Screen and Kelambu Trap for mosquito's surveillance in South and West Sulawesi, Indonesia (<https://smujo.id/biodiv/article/view/6616>)



NUR RAHMA

PDF (<https://smujo.id/biodiv/article/view/6616/4297>)

Genetic evaluation of tidal swamp rice from South Kalimantan, Indonesia based on the agro-morphological markers (<https://smujo.id/biodiv/article/view/6652>)

DINDIN HIDAYATUL MURSYIDIN, IZHAR KHAIRULLAH

PDF (<https://smujo.id/biodiv/article/view/6652/4298>)

Diversity of reef fish in Halang Melingkau Island, South Kalimantan, Indonesia (<https://smujo.id/biodiv/article/view/5947>)

FRANS TONY, SOEMARNO, DEWA GEDE RAKA WIADNYA, LUCHMAN HAKIM

PDF (<https://smujo.id/biodiv/article/view/5947/4299>)

Bacterial (9A2H) enhancement alters the nematode community structure and decomposition pathway of amended nutrient-limited soil (<https://smujo.id/biodiv/article/view/6340>)

DEMA R. LUCKYANA, I G. A. AYU RATNA PUSPITASARI, ARDHINI R. MAHARNING

PDF (<https://smujo.id/biodiv/article/view/6340/4300>)

Insect diversity in various distances to forest edge in small nature reserve: A case study of Bantarbolang Nature Reserve, Central Java, Indonesia (<https://smujo.id/biodiv/article/view/6691>)

DARSONO, EDY RIWIDIHARSO, SLAMET SANTOSO, EMING SUDIANA, EDY YANI, ERIE KOLLYA NASUTION, HEXA APRILLIANA, TITI CHASANAH

PDF (<https://smujo.id/biodiv/article/view/6691/4301>)

Morphometric analysis of *Harpodon nehereus*, *Harpiosquilla raphidea*, and *Scylla serrata* in the coastal waters of Tarakan, North Kalimantan, Indonesia (<https://smujo.id/biodiv/article/view/6632>)

GAZALI SALIM, KUN RETNO HANDAYANI, SUTRISNO ANGGORO, AGUS INDARJO, AGUNG DHAMAR SYAKTI, ABDUL JABARSYAH IBRAHIM, JULIAN RANSANGAN, LUKMAN YUDHO PRAKOSO

PDF (<https://smujo.id/biodiv/article/view/6632/4302>)

Community structure of arboreal and soil-dwelling arthropods in three different rice planting indexes in freshwater swamps of South Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/6650>)

TILI KARENINA, SITI HERLINDA, CHANDRA IRSAN, YULIA PUJIASTUTI, HASBI,

SUPARMAN, BENYAMIN LAKITAN, HARMAN HAMIDSON, ABU Umayah

PDF (<https://smujo.id/biodiv/article/view/6650/4303>)

The tolerance of oil palm (*Elaeis guineensis*) seedlings to Al stress is enhanced by citric acid and natural peat water  
(<https://smujo.id/biodiv/article/view/6644>)

AGUS NUR HIDAYAH, SUDIRMAN YAHYA, DIDY SOPANDIE

PDF (<https://smujo.id/biodiv/article/view/6644/4304>)

Characterization of BSL6 isolates isolated from honeybee hive and to determine its antibacterial activity  
(<https://smujo.id/biodiv/article/view/6775>)

LENNI FITRI, YEKKI YASMIN, FAUZIAH, DWI ANDRI SEPTIANI, SUHARTONO

PDF (<https://smujo.id/biodiv/article/view/6775/4305>)

Predicting potential impacts of climate change on the geographical distribution of mountainous selaginellas in Java, Indonesia  
(<https://smujo.id/biodiv/article/view/6864>)

AHMAD DWI SETYAWAN, JATNA SUPRIATNA, NISYAWATI, ILYAS NURSAMS, SUTARNO, SUGIYARTO, SUNARTO, PRAKASH PRADAN, SUGENG BUDIHARTA, ARI PITOYO, SAPTA SUHARDONO, PRABANG SETYONO, MUHAMMAD INDRAWAN

PDF (<https://smujo.id/biodiv/article/view/6864/4306>)

DNA barcoding of Crustacean larvae in the eastern areas of Segara Anakan Cilacap, Central Java Indonesia  
(<https://smujo.id/biodiv/article/view/6588>)

KUSBIYANTO, DIAN BHAGAWATI, AGUS NURYANTO

PDF (<https://smujo.id/biodiv/article/view/6588/4307>)

Rhizobacterial community structure in grafted tomato plants infected by *Ralstonia solanacearum* (<https://smujo.id/biodiv/article/view/5714>)

LISA NAVITASARI, TRI JOKO, RUDI HARI MURTI, TRIWIDODO ARWIYANTO

PDF (<https://smujo.id/biodiv/article/view/5714/4308>)

Wild edible plants in four Agni tribes of Central-east and Northeast of Côte d'Ivoire: a comparative study  
(<https://smujo.id/biodiv/article/view/6868>)

DJAH FRANÇOIS MALAN, AMANI LÉOPOLD LITTA, MÉNÉKÉ DISTEL KOUGBO, AMADOU LAMINE DIOP, KOUASSI GÉRARD KOUASSI

PDF (<https://smujo.id/biodiv/article/view/6868/4309>)

Perception, attitude, and motive of local community towards forest conversion to plantation in Dharmasraya District, West Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/6572>)

KORDIYANA K. RANGGA, YONARIZA, HELVI YANFIKA, ABDUL MUTOLIB

PDF (<https://smujo.id/biodiv/article/view/6572/4310>)

Analysis of two whale shark watching destinations in Indonesia: status and ecotourism potential (<https://smujo.id/biodiv/article/view/6032>)

ASRIL DJUNAIDI, JAMALUDDIN JOMPA, NADIARTI NADIARTI, AHMAD BAHAR, SUKIRMAN DJ. TILAHUNGA, DEBORAH LILIENFELD, MAULITA SARI HANI

PDF (<https://smujo.id/biodiv/article/view/6032/4317>)

Short Communication: Rediscovery of *Psychotria* species, subspecies, and varieties collected in the 1990s and new records of *Antirhea benguetensis* (Elmer) Valetton and *Ixora longifolia* Smith (Rubiaceae) in Northern Sierra Madre Natural Park, Luzon, Philipp (<https://smujo.id/biodiv/article/view/6375>)

RACHEL D. BIAG, GRECEBIO JONATHAN D. ALEJANDRO

PDF (<https://smujo.id/biodiv/article/view/6375/4311>)

Essential oils from *Vitex trifolia* as an effective repellent for *Aedes aegypti* (<https://smujo.id/biodiv/article/view/6712>)

NI LUH ARPIWI, I KETUT MUKSIN, ENIEK KRISWIYANTI

PDF (<https://smujo.id/biodiv/article/view/6712/4312>)

Short Communication: Investigating environmental impacts of long-term monoculture of sugarcane farming in Indonesia through DPSIR framework (<https://smujo.id/biodiv/article/view/6268>)

RIVANDI PRANANDITA PUTRA, MUHAMMAD RASYID RIDLA RANOMAHERA, MUHAMMAD SYAMSU RIZALUDIN, RAHMAD SUPRIYANTO, VITA AYU KUSUMA DEWI

PDF (<https://smujo.id/biodiv/article/view/6268/4313>)

Penja fish (Genus: *Sicyopterus*) from Karama River, West Sulawesi, Indonesia: Growth Pattern and Habitat Characteristics (<https://smujo.id/biodiv/article/view/6561>)

CUT MUTHIADIN MUTHIADIN, ISNA RASDIANA AZIZ, HASYIMUDDIN, FATMAWATI NUR, ST. AISYAH SIJID, SAIFULLAH AZMAN, RENNY KURNIA HADIATY, ILHAM

PDF (<https://smujo.id/biodiv/article/view/6561/4314>)

Short Communication: Callus induction in purple and white-purple varieties of *Orthosiphon aristatus* (Blume) Miq. (<https://smujo.id/biodiv/article/view/6569>)

FAHRAUK FARAMAYUDA, TOTIK SRI MARIANI, ELFAHMI ELFAHMI, SUKRASNO

PDF (<https://smujo.id/biodiv/article/view/6569/4315>)

Parasitism of cassava mealybug by *Anagyrus lopezi*: Effects of varying host and parasitoid densities (<https://smujo.id/biodiv/article/view/6426>)

MUHAMMAD ZAINAL FANANI, AUNU RAUF, NINA MARYANA, ALI NURMANSYAH, DADAN HINDAYANA

PDF (<https://smujo.id/biodiv/article/view/6426/4316>)

#### Information

For Readers (<https://smujo.id/biodiv/information/readers>)

For Authors (<https://smujo.id/biodiv/information/authors>)

For Librarians (<https://smujo.id/biodiv/information/librarians>)

#### Usage Statistics Information

We log anonymous usage statistics. Please read the privacy information (<https://smujo.id/biodiv/usageStats/privacyInformation>) for details.

#### Journals List

Biodiversitas Journal of Biological Diversity (<https://smujo.id/biodiv>)

Nusantara Bioscience (<https://smujo.id/nb>)

Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia (<https://smujo.id/psnmbi>)

Asian Journal of Agriculture (<https://smujo.id/aja>)

Asian Journal of Ethnobiology (<https://smujo.id/aje>)

Asian Journal of Forestry (<https://smujo.id/ajf>)

# Morphometric and genetic variations of species composers of nike fish assemblages in Gorontalo Bay Waters, Indonesia

FEMY M. SAHAMI<sup>1\*</sup>, RENE CHARLES KEPEL<sup>2</sup>, ABDUL HAFIDZ OLI<sup>1</sup>, SILVESTER BENNY PRATASIK<sup>2</sup>,  
RIDWAN LASABUDA<sup>2</sup>, ADNAN WANTASEN<sup>2</sup>, SITTY AINSYAH HABIBIE<sup>1</sup>

<sup>1</sup>Faculty of Fisheries and Marine Sciences, Universitas Negeri Gorontalo. Jl. Jend. Sudirman No. 6, Gorontalo City 96128, Gorontalo, Indonesia.  
Tel.: +62-435-821125, Fax.: +62-435-821752. \*email: femysahami@ung.ac.id

<sup>2</sup>Faculty of Fisheries and Marine Sciences, Universitas Sam Ratulangi. Jl. Kleak Bahu, Manado 95115, North Sulawesi, Indonesia

Manuscript received: 13 July 2020. Revision accepted: 11 September 2020.

**Abstract.** Sahami FM, Kepel RC, Oli AH, Pratasik SB, Lasabuda R, Wantasen A, Habibie SA. 2020. Morphometric and genetic variations of species composers of nike fish assemblages in Gorontalo Bay Waters, Indonesia. *Biodiversitas* 21: 4571-4581. Nike is Gobioidae fish at the post-larval and juvenile stages whose habitat is still in seawater before they migrate to the freshwater, grow up, and spawn to fulfill their life cycle as an amphidromous species. This study aims to identify the species composers of Nike fish in Gorontalo Bay waters based on their morphometric and molecular characters. 2,523 samples were collected from the catches of fishermen during three periods of their appearance in Gorontalo Bay waters from January to March 2019. The samples were grouped based on their similarity of melanophore patterns, and morphometric characters of 10 units were then measured. This study found 20 different groups of melanophore patterns; 15 of them were new melanophore patterns. DNA samples from each group of new melanophore patterns were then isolated for molecular analysis. The morphometric analysis grouped the 20 melanophore patterns into three separate clusters that were confirmed through molecular analysis. The results of Gen Cytochrome Oxidase I (COI) sequences indicate that the new melanophore patterns of Nike fish assemblages consisting of six species; five species in the Gobiidae family (i.e. *Sicyopterus parvei*, *S. cynocephalus*, *S. longifilis*, *S. lagocephalus*, and *Stiphodon semoni*) and a species in the Eleotridae family (*Belobranchus belobranchus*).

**Keywords:** Amphidromous, COI gene, Eleotridae, Gobiidae, molecular

## INTRODUCTION

Nike (local name) is a designation for a goby fish group in the post-larval to the juvenile stages that seasonally appear in Gorontalo Bay waters, usually in the last quarter moon phase towards the new moon. The people of Gorontalo catch this fish for consumption as well as in other areas, such as Nike in North Sulawesi (Pangemanan et al. 2020), Penja in West Sulawesi (Nurjirana et al. 2019a; Nurjirana et al. 2019b), and Dulong by the Philippines (Thomas et al. 2013). As a group of amphidromous fish, the catching is usually done when they migrate from the sea to the river. Keith (2003); Yamasaki et al. (2011); Taillebois et al. (2012); and Mennesson et al. (2019) mention that adult amphidromous fish will spawn in freshwater, the eggs are placed on the substrate at the bottom of the water, and the larvae are then carried away by the estuary area into the sea. After the larvae live in the sea, they will then return to the river at the post-larval and juvenile stages. Oli et al. (2017) and Pasingi and Abdullah (2018) report that Nike fish in Gorontalo Bay will first appear in the sea and move closer to the estuary areas by time until they finally disappear.

The local communities and general public believe Nike fish as a single species. Usman (2016) reported that Gorontalo Nike fish has been identified as *Awaous melanocephalus* Bleeker 1849. Furthermore, Oli et al. (2019) reported that Nike fish is *Sicyopterus longifilis* de Beaufort 1912. Several studies were then conducted to

investigate reality. Sahami et al. (2019b), in her recent study, reported that the composers of Nike fish assemblages in Gorontalo Bay consist of four species (i.e. *Sicyopterus pugnans* Ogilvie-Grant 1884, *Sicyopterus cynocephalus* Valenciennes 1837, *Bunaka gyrinoides* Bleeker 1853, and *Belobranchus segura* Keith, Hadiaty and Lord 2012). Meanwhile, Nurjirana et al. (2019b) also found similar findings that Nike fish is composed of species in the Gobiidae and Eleotridae family. However, limited studies reported the diversity of similar fish assemblages in other aquatic areas. Nurjirana et al. (2019a) reported Penja fish in West Sulawesi consisting of six genera and nine species (i.e. *Sicyopterus lagocephalus* Pallas 1770, *Sicyopterus longifilis*, *Stiphodon semoni* Weber 1895, *Stiphodon atropurpureus* Herre 1927, *Sicyopus zosterophorum* Bleeker 1856, *Smilosicyopus leprurus* Sakai and Nakamura 1979, *Schismatogobius* sp., *Eleotris fusca* Forster 1801, and *Eleotris* sp.). Furthermore, Pangemanan et al. (2020) reported Nike fish in Tondano Lake to consist of six different melanophore patterns that belong to the same species *Ophioleotris aporos*.

The popularity of Nike fish, which is much favored by the community and its high economic value, has a significant impact on the high level of fishing. However, scientific studies on these fish in bioecological, fishing, and economic are still limited. It is feared that limited information and uncontrolled fishing will reduce diversity if no rapid and appropriate management is carried out. As an initial step, research related to the morphometric and

molecular variations of the species that make up the Nike fish assemblage is critical to finding out the bioecological information of species. This particular information can be used as a basis for its sustainable management. Generally, research on the morphometric and molecular of Nike fish in Gorontalo has never been conducted. The morphometric and molecular data of the composers of Nike fish are crucial to validate the taxonomic status. These data are often combined to overcome the limitations of the morphological identification which heavily influenced by the environment (Firawati et al. 2017; Habibie et al. 2018). Because the determination of juvenile gobies down to the species level based on morphological characters is difficult to be carried out (Yokoo et al. 2011), Also, melanophores can be found in newly hatched gobies larvae (Yamasaki et al. 2011), Hence this study using a grouping strategy based on the similarity of the melanophore patterns. This study aims to identify the species composers of Nike fish assemblages in Gorontalo Bay based on morphometric and molecular characters.

## MATERIALS AND METHODS

### Sampling

The samples were obtained from the catches of fishermen during the three occurrence periods (i.e. January–March 2019) in Gorontalo Bay to the estuary of Bone Bolango River (Figure 1). The sampling was carried out from the first day until the last day in each appearance period. The sampled fishes were temporarily preserved in an icebox (4 °C) and were transported to the laboratory for further analysis. The morphology of the Nike fish is recognized by the morphological features described by Olii et al. (2019) and Pasisingi et al. (2020a). The sample

grouping referred to the initial method used by Sahami et al. (2019b) based on the differences in melanophore patterns in the body. 20 groups of sample were found in this study, in which 15 groups were new melanophore patterns and coded with N6–N20, while five groups (N1–N5) were the melanophore patterns that had been reported Sahami et al. (2019b). The measurement of morphometric characters was carried out on 20 groups of melanophore patterns, whereas the samples for molecular analysis were only obtained from 15 samples of newly discovered melanophore patterns. Immediately after the measurement of morphometric characters, five individuals were taken from each group and each of them was then placed in a sample bottle and added with 95% ethanol solution for molecular analysis.

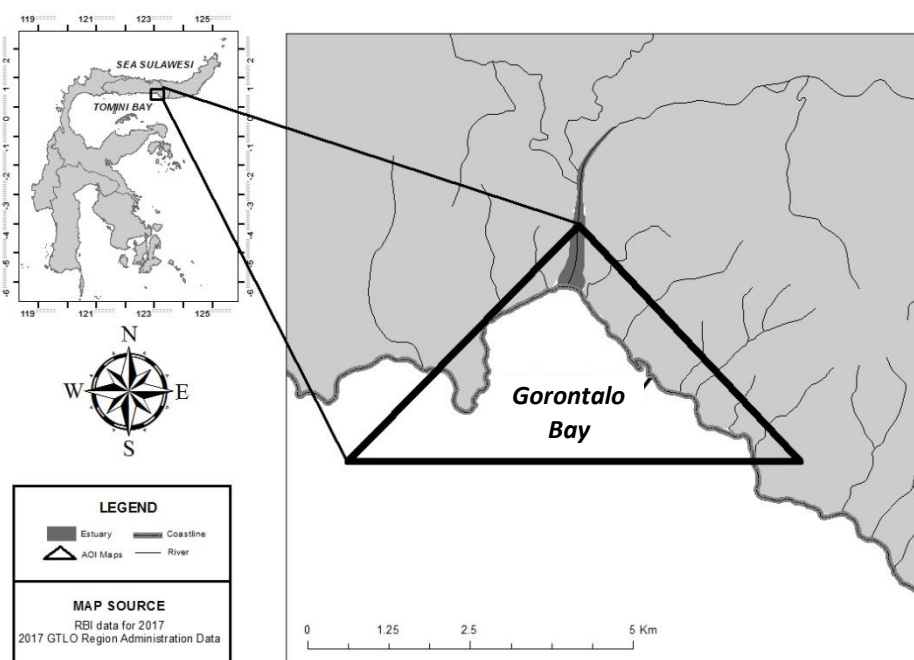
### Morphometric characters

The morphometric characters of Nike fish consist of 10 characters modified from Benbow et al. (2004) (Figure 2 and Table 1). The ten characters were chosen because they are easily observable parts of the body, while the other body parts are still not fully developed. The measurement was performed using Image-J application.

Pasisingi et al. (2020a) stated that Nike fish population shows a positive allometric growth pattern. Therefore, each measured morphometric character data was then standardized by following the allometric formula according to Elliott et al. (1995) as follows:

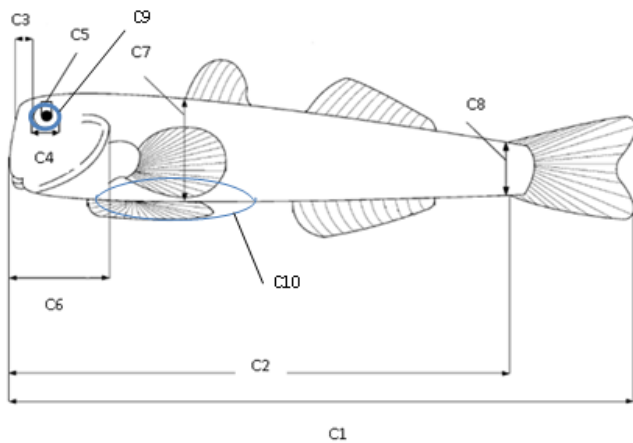
$$M_{adj} = M (L_s/L_0)^b$$

$M_{adj}$  is the standardized morphometric data,  $M$  is the measured morphometric data,  $L_0$  is the total length of fish,  $L_s$  is the average total length, and parameter  $b$  is the slope of log-linear curve  $M$  to  $\log L_0$  of all data.



**Figure 1.** Map of the research location in Gorontalo Bay Waters, Gorontalo Province, Indonesia





**Figure 2.** Morphometric characters of Nike fish (modified from Benbow et al. 2004)

**Table 1.** Morphometric characters of Nike fish (modified from Benbow et al. 2004)

No.	Morphometric characters	No.	Morphometric characters
C1	Total Length (TL)	C6	Head Length (HL)
C2	Standard Length (SL)	C7	Body Depth (BD)
C3	Preorbital Length (PL)	C8	Peduncle Depth (PD)
C4	Eye Diameter (ED)	C9	Eye Area (EA)
C5	Eye Pupil Diameter (EP)	C10	Yolk Sac area (YS)

### DNA extraction, PCR amplification, and sequencing

Molecular analysis was carried out through several stages including collection of fish tissue, Deoxyribonucleic acid (DNA) extraction, Polymerase Chain Reaction (PCR) DNA, electrophoresis, and DNA sequencing. The DNA was extracted using Genomic DNA Mini Kit Tissue by following the protocol of the kit. Approximately  $\pm 30$  mg samples of fish muscle tissue were taken and put into a 1.5 ml microcentrifuge tube, subsequently 200  $\mu$ l GT Buffer was added and homogenized by grinding. Furthermore, 20  $\mu$ l of Proteinase K was added and incubated at 60 °C for 30 minutes, with inverting the tube every 5 minutes during incubation. 200  $\mu$ l GBT Buffer was added and vortexed for five seconds. The mixture was incubated at 60 °C for 20 minutes, with inverting the tube every 5 minutes. Also, 200  $\mu$ l absolute ethanol was added and vortexed for 10 seconds, and then the sample was placed to the GS column in a 2 ml collection tube and centrifuged at 14,000–16,000 g for two minutes. The collection tube was discarded and transferred the GS column to a new collection tube. 400  $\mu$ l W1 Buffer was added to the GS column and centrifuged at 14,000–16,000 g for thirty seconds. The supernatant was removed, and the 600  $\mu$ l Wash Buffer was added to the GS column and centrifuged at 14,000–16,000 g for thirty seconds. After that, the supernatant was discharged, and the GS column was placed back in the collection tube and centrifuged at 14,000–16,000 g for three minutes. In the final step, the dried GS column was placed to a clean microcentrifuge tube, and the pre-heated Elution Buffer was added and centrifuged at 14,000–16,000 g for thirty seconds.

The mitochondrial Cytochrome Oxidase subunit I (COI) gene was chosen because the resolution of the COI gene at the intraspecific level is better than other core genes, so it was appropriate to be used to identify the species up to the intraspecific level (Ströder-Kypke and Lynn 2010). The mitochondrial DNA COI gene was further amplified using a forward primer pair FF2d 5'-TTC TCC ACC AAC CAC AAR GAY ATY GG-3' and reverse primer FR1d 5'-CAC CTC AGG GTG TCC GAA RAA YCA RAA-3' (Ivanova et al. 2007). One sample, i.e. N16, was amplified using the LCOI490 forward primer pair (5'-GGT CAA CAA ATA ATA AAG ATA TTG G-3') and reverse primer HC02198 5'-TAA ACT TCA GGG TGA CCA AAA AAT CA-3' (Folmer et al. 1994) because it was unsuccessfully amplified using FF2d and FR1d primers. The PCR profiles were predenaturation at 94°C for five minutes, denaturation at 94°C for 30 seconds, primary attachment at 50°C for 30 seconds, elongation at 72°C for 45 seconds, and final elongation at 72°C for seven minutes. The PCR process lasted for 40 cycles and the DNA samples that had been amplified and electrophoresed were then sequenced. The sequencing process was performed at Malaysia's 1<sup>st</sup> Base Laboratory through PT Genetika Science Indonesia by sending samples consisting of PCR Product of 30  $\mu$ l DNA samples, 10  $\mu$ l forward primers, and 10  $\mu$ l reverse primers.

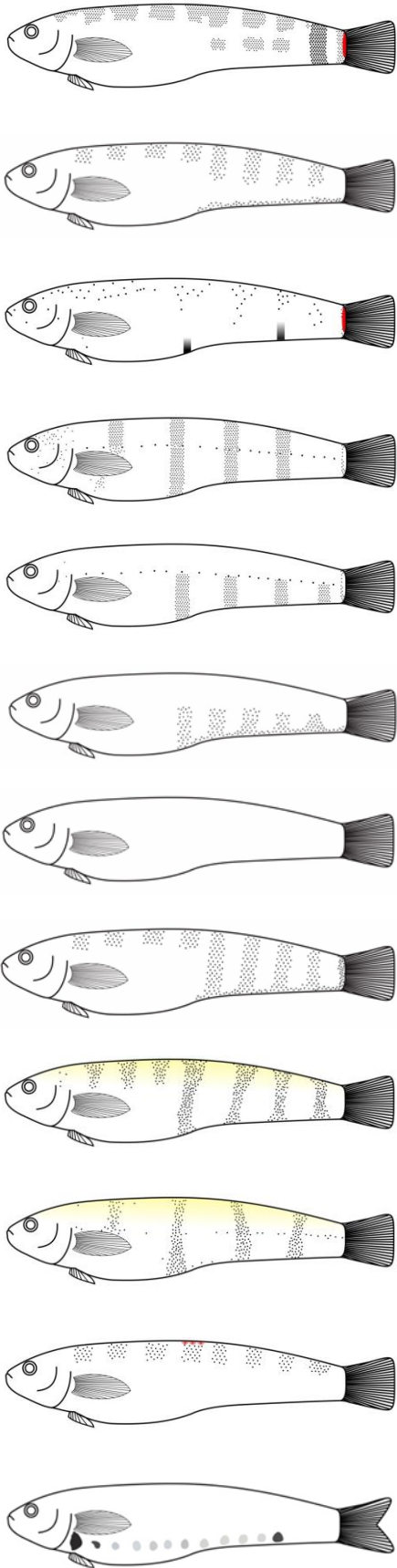
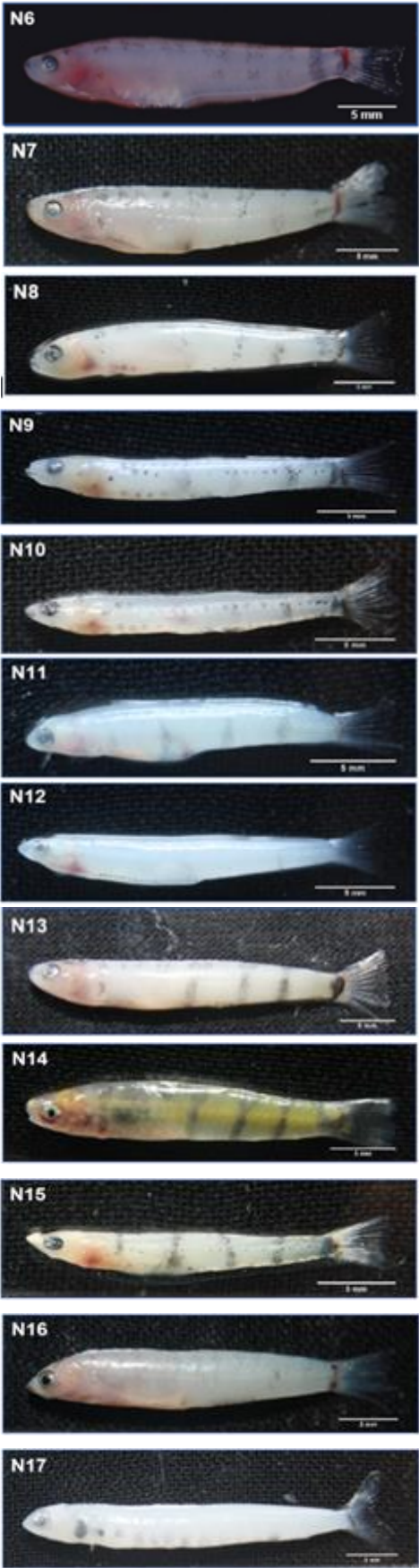
### Data analysis

The standardized morphometric characters were analyzed using Discriminant Function Analysis (DFA) (Landau and Everit 2004) using IBM SPSS Statistics 20. The molecular data sequencing process was carried out using Dideoxy Sanger Termination Method through PT Genetika Science Indonesia. Nucleotide sequences from DNA sequencing that had been processed and carried out by CONTIG were then matched with data available on the National Center for Biotechnology Information (NCBI) databases through the BLAST (Basic Local Alignment Search Tool). Phylogenetic trees are arranged by aligning the DNA sequences of the identified samples with some goby DNA samples available in the GenBank database. The phylogenetic tree was created using Maximum Likelihood 1000 bootstrap method in MEGA 6.0 software.

## RESULTS AND DISCUSSION

### Species identification

Nike is a group of small fish at the post-larval and juvenile stages which generally have a transparent body at the beginning until they turn blackish at the end of the appearance period when the fish have entered the river estuary (Pasingi et al. 2020a). Based on a cursory observation, Nike fish is a composition of small fish grouped with the same morphological appearance. However, if this is observed in detail, the fish show a variety of melanophore patterns on their bodies. From a total of 2,523 Nike fish samples caught during the study period, 1,856 fish samples were found with different melanophore patterns than previously reported by Sahami et al. (2019b). This study found 15 new melanophore patterns (sample code N6–N20) presented in Figure 3.







**Figure 3.** A new record on the melanophore pattern diversity of species composers of Nike fish in Gorontalo Bay Waters (notes: the sketch of melanophore pattern does not use actual fish size)

Generally, the caught Nike fish have a total length of 16.22–37.69 mm, do not have scales, the fins are not perfect, and the caudal fins tend to form truncates. One sample, i.e. N17, is the only sample whose caudal fins form a clear fork. Each group of melanophore patterns was caught in a range of different sizes as presented in Table 2. This table shows that the Nike fish assemblages do not only consist of fish with different melanophore patterns, but also different sizes. In a single Nike catch, the size of each group of melanophore patterns is very diverse and shows a certain tendency to group. The highest caught samples in the observation period were 508 for N1, while the lowest caught samples were N4 and N17 (i.e. one sample for each).

### Morphometric data analysis

Morphometric characters can be used in taxonomies as initial identification in fisheries (Sara et al. 2016). A summary of the results of morphometric character data measurements that have been standardized follows the allometric formula Elliott et al. (1995) as presented in Table 3.

Discriminant analysis is an analysis used to define morphometric characters distinguishing among populations (Landau and Everit 2004). The distribution of the discriminant coefficient values presented in the form of canonical discriminant function diagrams shows the 20 types of species that compose the Nike fish assemblages with different melanophore patterns in Gorontalo Bay forming three clusters as presented in Figure 4.

Each of the two discriminant functions can describe 63.9% and 19% of the total morphometric variant characters. Based on the analysis of discriminant functions, the C6 (head length) character was the highest character, which suggested that the main distinguishing character among Nike populations in the Gorontalo Bay waters could be determined from the head length character. Figure 4 obviously shows that Nike fish samples in the Gorontalo Bay waters formed three clusters, N1, N2, N4, N6, N7, N8, N13, N14, N16, N18, N19, and N20) in the first cluster;

N3, N4, N5, N9, N10, and N15 in the second cluster; and N11 and N12 in the third cluster. One sample, i.e. N17, does not show a tendency to be included in certain clusters. Besides, the forked caudal fin shows that N17 is not a member of the goby group and is strongly suspected of being accidentally caught.

Sahami et al. (2019b) reported species N1 as *S. pugnans*; N2 as *S. cynocephalus*; N3 and N5 as *B. segura*; and N4 as *B. gyrinoides*. The diagram of canonical discriminant function classifies N1 and N2 in the first cluster, so it is strongly alleged that other species in the first cluster (N4, N6, N7, N8, N13, N14, N16, N18, N19, and N20) are species in the *Sicyopterus* genus or at least is a species in the Gobiidae family. Also, N3, N4, and N5 as species in Eleotridae family are present in the second cluster, so it is also strongly alleged that other species in the second cluster (N9, N10, and N15) are the members of Eleotridae family. On the other hand, N11 and N12 as separate clusters have not yet ascertained for the tendency of their species identity. However, the morphological character with the fused pelvic fins implies that both species are the members of Gobiidae family and not generated from the *Sicyopterus* genus. Nurjirana et al. (2019b) stated that the fundamental difference from the morphology of Gobiidae and Eleotridae fish lies in the shape of the pelvic fins, where the Gobiidae fish has fused pelvic fins, forming a ventral disc and Eleotridae has separated pelvic fins.

### Molecular analysis

The molecular analysis succeeded in identifying 14 of the 15 new melanophore pattern samples, while one sample, N17, was not identified since the sample was damaged and there were no more sample reserves. The results of mitochondrial COI gene sequencing indicate that the Nike fish assemblages in Gorontalo Bay consist of six different species. The results of BLAST of DNA mitochondrial COI gene sequence data on [www.blast.ncbi.nlm.nih.gov](http://www.blast.ncbi.nlm.nih.gov) are presented in Table 4.

**Table 2.** Range of catch size of each species composers of Nike fish assemblages in Gorontalo Bay, Indonesia

Sample code	Mean of total length (cm)	Range of total length (cm)	Number of samples
N1	2.765	1.964–3.547	508
N2	2.764	2.383–3.326	81
N3	2.153	1.917–2.372	54
N4	2.089	2.089	1
N5	2.063	1.892–1.943	23
N6	3.043	2.345–3.658	190
N7	2.777	2.415–3.748	399
N8	2.796	2.379–3.333	277
N9	2.204	1.897–2.362	27
N10	2.314	2.283–2.344	2
N11	1.931	1.622–2.103	140
N12	2.019	1.694–2.369	191
N13	2.767	2.480–3.347	240
N14	2.642	2.386–2.863	50
N15	2.181	2.002–2.357	42
N16	3.042	2.579–3.769	129
N17	3.768	3.768	1
N18	2.952	2.840–3.118	4
N19	3.208	2.900–3.507	31
N20	2.774	2.452–3.628	133
Total sample			2,523

Some samples with different melanophores had the same genetic profile so that they were identified as the same species. Table 3 shows that the Nike fish assemblages in Gorontalo Bay are composed of six species from two different families (i.e. *S. parvei* Bleeker 1853, *S. cynocephalus*, *S. longifilis*, *S. lagocephalus*, and *Stiphodon semoni*) from the Gobiidae family; and *Belobranchus belobranchus* Valenciennes 1837 from the Eleotridae family. One species, *S. longifilis*, is the same species as reported by Olii et al. (2019) without a description of specific melanophore patterns, and one species, *S. cynocephalus*, is also the same species with a different melanophore pattern as reported by Sahami et al. (2019b).

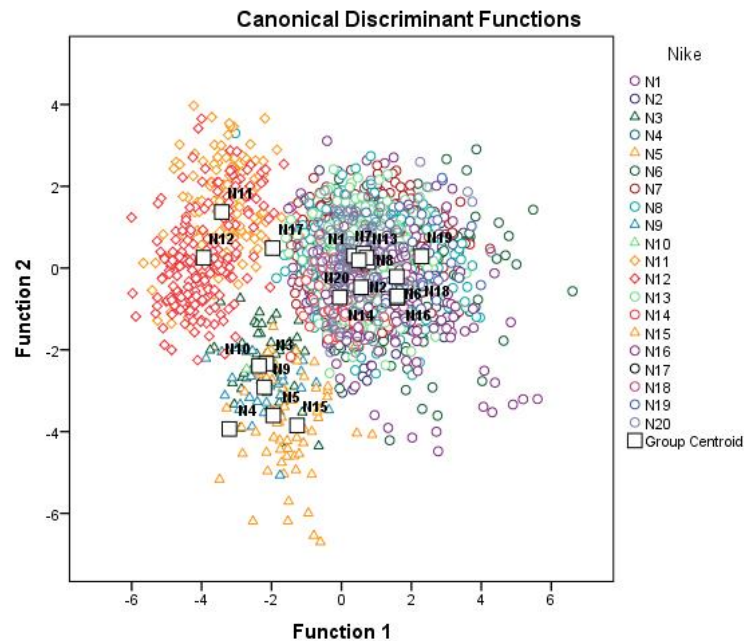
**Table 4.** The Results of Nike Fish BLAST in Gorontalo Bay on NCBI website

Sample code	Species
N6	<i>Sicyopterus parvei</i>
N7	<i>Sicyopterus longifilis</i>
N8	<i>Sicyopterus cynocephalus</i>
N9	<i>Belobranchus belobranchus</i>
N10	<i>Belobranchus belobranchus</i>
N11	<i>Stiphodon semoni</i>
N12	<i>Stiphodon semoni</i>
N13	<i>Sicyopterus longifilis</i>
N14	<i>Sicyopterus longifilis</i>
N15	<i>Belobranchus belobranchus</i>
N16	<i>Sicyopterus cynocephalus</i>
N18	<i>Sicyopterus lagocephalus</i>
N19	<i>Sicyopterus parvei</i>
N20	<i>Sicyopterus longifilis</i>

The results of molecular analysis were able to identify the samples up to the species level and further clarify the results of morphometric analysis. The first cluster was a group of species in the genus *Sicyopterus*; the second cluster was a group of species in the Eleotridae family, and the third cluster was a group of species in the genus *Stiphodon*. Alleged N11 and N12 samples as the members of species in the Gobiidae family and not the members of species in the genus *Sicyopterus* were also confirmed through molecular analysis that succeeded in identifying the two species as *Stiphodon semoni* species. Overall, it can be emphasized that Nike fish has a fairly high level of diversity, both in terms of its constituent species and melanophore patterns at the species level. The overall kinship relationships of the species of Nike fish assemblages in the Gorontalo Bay waters based on the nucleotide sequence of the mitochondrial DNA COI gene are presented in Figure 5.

**Table 3.** Morphometric characters data of each species composers of Nike fish assemblages in Gorontalo Bay, Indonesia

Sample code	Unit of Character (cm)								
	SL	PL	ED	EP	HL	BD	PD	EA	YS
N1	2.237±0.10	0.112±0.02	0.131±0.01	0.116±0.13	0.447±0.04	0.403±0.09	0.188±0.08	0.018±0.01	0.063±0.02
N2	2.214±0.05	0.117±0.02	0.132±0.02	0.057±0.02	0.442±0.05	0.405±0.04	0.228±0.03	0.014±0.00	0.060±0.03
N3	2.257±0.07	0.137±0.01	0.136±0.01	0.073±0.02	0.525±0.03	0.383±0.02	0.155±0.01	0.018±0.00	0.038±0.02
N4	2.333±a	0.118±a	0.166±a	0.086±a	0.841±a	0.502±a	0.183±a	0.023±a	0.201±a
N5	2.258±0.08	0.158±0.02	0.150±0.01	0.095±0.02	0.557±0.04	0.379±0.02	0.156±0.02	0.022±0.00	0.065±0.03
N6	2.246±0.04	0.118±0.02	0.130±0.01	0.141±0.17	0.476±0.04	0.406±0.10	0.197±0.11	0.030±0.04	0.071±0.04
N7	2.243±0.04	0.114±0.02	0.133±0.01	0.144±0.02	0.438±0.03	0.390±0.10	0.179±0.09	0.018±0.01	0.062±0.02
N8	2.238±0.01	0.116±0.02	0.133±0.01	0.168±0.18	0.456±0.05	0.381±0.11	0.168±0.11	0.023±0.02	0.072±0.03
N9	2.211±0.04	0.146±0.02	0.128±0.02	0.062±0.02	0.525±0.03	0.365±0.02	0.161±0.02	0.016±0.00	0.046±0.02
N10	2.205±0.04	0.120±0.00	0.138±0.00	0.039±0.01	0.502±0.01	0.344±0.01	0.169±0.00	0.017±0.00	0.045±0.01
N11	2.222±0.04	0.095±0.02	0.131±0.01	0.083±0.02	0.411±0.04	0.376±0.03	0.122±0.02	0.018±0.00	0.080±0.03
N12	2.256±0.04	0.108±0.02	0.123±0.01	0.074±0.02	0.434±0.03	0.349±0.04	0.116±0.02	0.015±0.00	0.061±0.04
N13	2.245±0.04	0.112±0.02	0.132±0.01	0.154±0.16	0.456±0.04	0.389±0.11	0.172±0.20	0.022±0.02	0.059±0.02
N14	2.240±0.03	0.111±0.01	0.139±0.01	0.061±0.01	0.445±0.03	0.381±0.03	0.210±0.02	0.015±0.00	0.047±0.01
N15	2.189±0.04	0.154±0.02	0.140±0.01	0.079±0.02	0.543±0.04	0.356±0.02	0.177±0.01	0.018±0.01	0.056±0.02
N16	2.216±0.04	0.111±0.02	0.133±0.01	0.045±0.01	0.438±0.05	0.394±0.03	0.258±0.03	0.012±0.00	0.051±0.01
N17	2.352±a	0.069±a	0.122±a	0.039±a	0.387±a	0.272±a	0.187±a	0.010±a	0.047±a
N18	2.229±0.02	0.110±0.02	0.133±0.00	0.049±0.00	0.409±0.01	0.369±0.02	0.252±0.02	0.010±0.00	0.037±0.01
N19	2.225±0.03	0.113±0.01	0.124±0.00	0.038±0.00	0.440±0.02	0.460±0.03	0.279±0.02	0.009±0.00	0.057±0.02
N20	2.243±0.05	0.109±0.01	0.131±0.01	0.172±0.17	0.462±0.05	0.369±0.10	0.152±0.10	0.029±0.03	0.065±0.02



**Figure 4.** Canonical discriminant function of nike fish in Gorontalo Bay Waters, Indonesia

The phylogenetic tree (Figure 5) shows that the species composing the Nike fish in the Gorontalo Bay waters form two monophyletic clades as family clades. The first monophyletic clade is the Gobiidae family clade which includes two genera and six species. The first genus is *Sicyopterus* which includes five species (i.e. *S. cynocephalus*, *S. parvei*, *S. lagocephalus*, *S. longifilis*, and *S. pugnans*). The second genus is *Stiphodon* which consists of only one species (i.e. *Stiphodon semoni*). The second monophyletic clade is the Eleotridae family which includes two genera and three species (i.e. *Bunaka gyrinoides*, *Belobranchus segura*, and *B. belobranchus*).

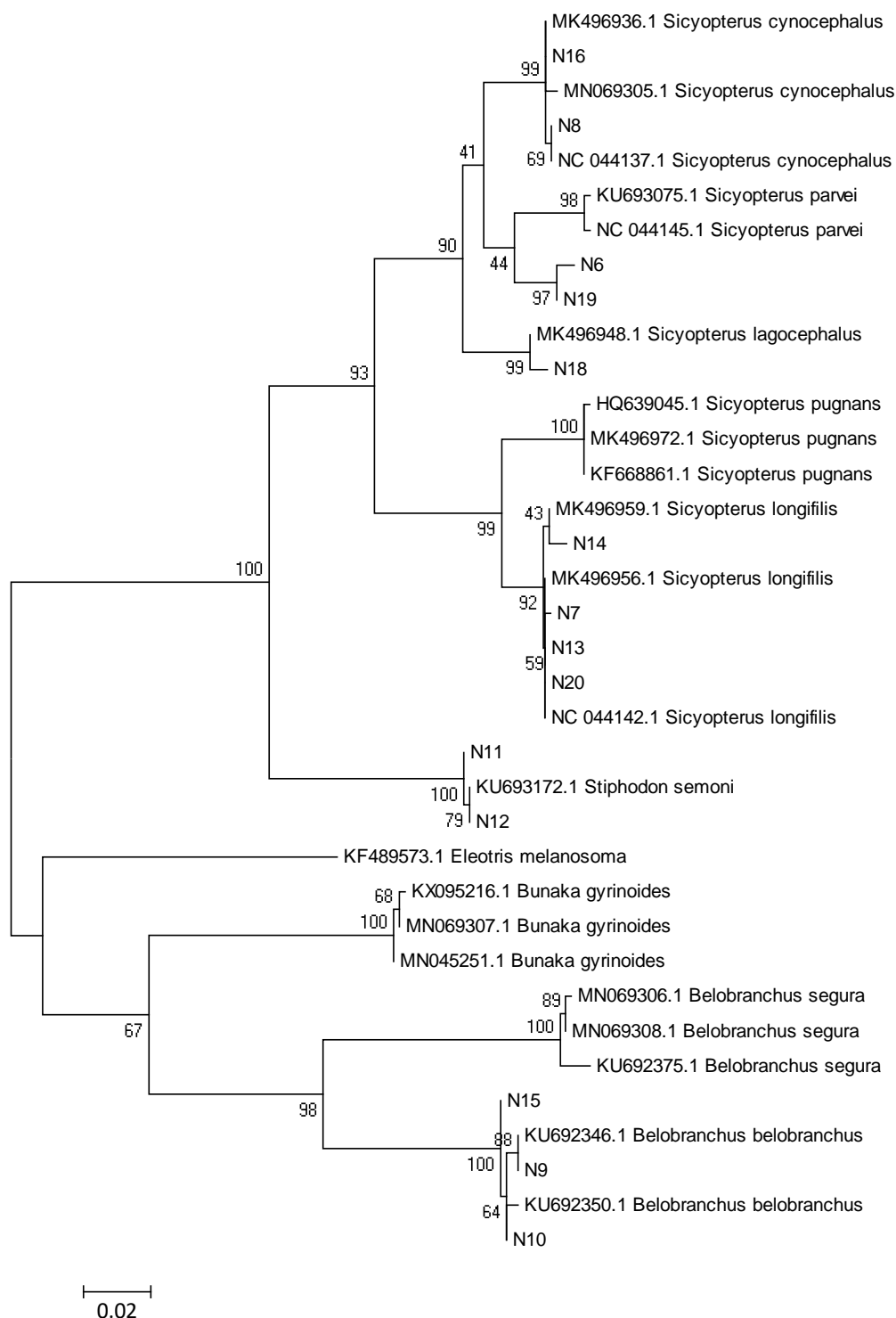
## Discussion

Fish school migration strategy is a consequence of the amphidromous species in avoiding predators and foraging food when migrating from marine waters at the post-larval stage to the river (Keith 2003). According to Thacker and Roje (2011), the diversity of Gobies at the post-larval and juvenile stages is often unnoticed because of their small size and unclear ecology. The use of melanophore patterns in morphological grouping is inspired by the research conducted by Yamasaki et al. (2011) which stated that the larvae of newly hatched goby can be distinguished based on their melanophore pattern.

This study found 15 new melanophore patterns (Figure 3) that can distinguish and classify the fish composing Nike fish assemblages from one another. The combination of their morphological characters and diagram of canonical discriminant function (Figure 4) shows that morphometric characters can be used in determining samples up to family level, but it cannot identify the samples up to the genus or

even species level. These results are in line with research conducted by Watanabe et al. (2011) which also had not been able to identify the *S. japonicus* post-larvae based on its morphological characters since the morphology is still very common as the morphological characters of other Gobioidae fish larvae. Thacker and Roje (2011) stated that Gobioidae fish have few morphological characters that can be used to group subgroups in the family even though the diversity of its species is quite high. Roesma et al. (2020) said that Gobies develop various morphological specialties as an adaptation to their environment, making it difficult to estimate the evolutionary scenarios by using morphological information only.

Subsequently, molecular identification was performed to confirm the identity of species that cannot be demonstrated either by the morphological features of the species or their morphometric characters. Mitochondrial DNA markers (mtDNA) had been widely used for most systematic molecular studies compared to nuclear DNA due to the large number of copies obtained from one cell, their small size, haploid in nature, and evolving faster (Teletchea 2009). The COI gene is the fastest and most reliable gene used as a barcoding marker to identify species (Hubert et al. 2008; Bingpeng et al. 2018; Roesma et al. 2018; Roesma et al. 2019). Initially, the COI gene has also been widely used to identify the species in Gobioidae assemblages (Jeon et al. 2012; Thomas et al. 2013; Viswambaran et al. 2013; Jin et al. 2014; Taillebois et al. 2014; Lejeune et al. 2016; Wang et al. 2017; Linh et al. 2018; Olii et al. 2019; Roesma et al. 2020). Therefore, this study also used the COI gene to identify species.



**Figure 5.** Phylogenetic tree of Nike fish composers in the Gorontalo Bay Waters, Indonesia

Several samples with different melanophore patterns were found having the same genetic identity. This was affected by some factors, such as environment, age, and natural dichromatism that might appear when the adult stage. Ellien et al. (2014); Valade et al. (2009) explained that *S. lagocephalus* larvae changes in the appearance of chromatophores in its body that starts from the head area and spreads along the body as the larvae get older. The identical results were obtained by Sahami et al. (2019a),

which found an increase in the number of melanophores in the body of the Nike *Belobranchus segura* fish when entering the estuary areas. Keith (2003) noted that freshwater Gobioidae fish are not hermaphrodite and do not have sexual change or alternative sexual strategies, but usually occur in sexual dichromatism in adult stage, where males have a brighter color than females. Larmuseau et al. (2010), in his research, revealed that natural selection might also affect the genetic variation in cone opsins in

species that could have an impact on the evolution of polymorphism.

The results of molecular identification indicate that the new melanophore patterns of Nike fish in Gorontalo Bay waters were composed of six species (i.e. *S. parvei*, *S. cynocephalus*, *S. longifilis*, *S. lagocephalus*, *B. Belobranchus*, and *Stiphodon semoni*). Nike fish was initially reported as a single species *A. Melanocephalus* by Usman (2016) and *Sicyopterus longifilis* by Olii et al. (2019). Recently, Sahami et al. (2019b) found the diversity of the composers species of Nike fish is *S. pugnans*, *S. cynocephalus*, *Bunaka gyrinoides*, and *Belobranchus segura*. This study successfully found and identified four new composers species of Nike fish, such as *S. parvei* and *S. lagocephalus*, and *Stiphodon semoni* generated from the Gobiidae family, and *B. Belobranchus* generated from the Eleotridae family.

94.09% (2,374 samples) out of a total of 2,523 samples whose morphometric characters were observed are species in the Gobiidae family. In addition to the high quantity of the catches, the species in the Gobiidae family also show its highest diversity of melanophore and genetic patterns compared to the Eleotridae family. According to Thacker and Roje (2011), Gobiidae is one of the largest Acanthomorph fish assemblages consisting of  $\pm 1,120$  species from 30 genera that have been described. Sicydiinae subfamily (Teleostei: Gobioidi) is the largest subfamily that contributes to the diversity of fish communities in tropical river waters with nine genera and more than 110 species that have been described. Nine genera of the Sicydiinae subfamily are *Sicydium* Valenciennes 1837; *Sicyopterus* Gill 1860; *Lentipes* Günther 1861; *Sicyopus* Gill 1863; *Cotylopus* Guichenot 1864; *Stiphodon* Weber 1895; *Parasicydium* Risch 1980; *Smilosicyopus* Watson 1999; and *Akihito* Watson, Keith and Marquet 2007 (Keith et al. 2011; Taillebois et al. 2014). The genus *Sicyopterus* of the Sicydiinae subfamily is the genus with the highest diversity of species and is widely distributed to the Indo-Pacific tropical islands (Keith et al. 2005; Keith et al. 2015; Lord et al. 2019). It strengthens the results of this study which found *Sicyopterus* as the genus with the highest diversity of Gorontalo Bay waters.

The *S. parvei* species are known to be Indonesian local endemic (LE) (Lord et al. 2019). Its distribution in Indonesia was found in Manggarai, Flores (Tjakrawidjaja 2002); Sukamade river, East Java (Rukmana et al. 2014); and Java and Bali (Dahrudin et al. 2016). Meanwhile, *S. lagocephalus* species is known as the species of genus *Sicyopterus* with the most extensive distribution in the Indo-Pacific region (Keith et al. 2005; Lord et al. 2019). This species was also found in La Réunion island (Keith et al. 2008); Vanuatu, Futuna and Okinawa (Keith et al. 2011); Buleleng, Bali (Dahrudin et al. 2016); Leppangan river, East Sulawesi (Nurjirana et al. 2019a); and Luwuk Banggai, Central Sulawesi (Gani et al. 2019).

The adult species of *B. belobranchus* was found in Bone river, Gorontalo (Pasingi et al. 2020b), and further strengthen the discovery at the post-larval and juvenile stages in this study. Besides, the distribution of this species

in Indonesia had been reported in Manggarai, Flores (Tjakrawidjaja 2002); Sukamade, East Java (Rukmana et al. 2014); and Luwuk Banggai, Central Sulawesi (Gani et al. 2019). The discovery of *B. belobranchus* species in the Gorontalo Bay waters contributes to the diversity of species in the genus *Belobranchus* which was previously only found for one species, i.e. *B. segura*.

The *Stiphodon semoni* species, the Opal cling goby, is one of the economically important species in the world of ornamental fish trade (Maeda and Tan 2013; Hubert et al. 2015). The distribution of this species in Indonesia was found in Lampung (Watson 2008), Bengkulu (Maeda and Tan 2013), Sukabumi, West Java (Dahrudin et al. 2016); Leppangan River, West Sulawesi (Nurjirana et al. 2019a); and Luwuk Banggai, Central Sulawesi (Gani et al. 2019).

The *A. melanocephalus* species, which was initially reported by Usman (2016) as a Nike species in Gorontalo Bay, was not found in this study because the sampling time did not coincide with the spawning time of the species. As explained in Yamasaki et al. (2011), it showed that the spawning season for *A. melanocephalus* was June to November, while the sampling was done in January-March. Besides, species extinction might occur due to overfishing and habitat change. However, in-depth research needs to be conducted to fulfill scientific information on Gorontalo aquatic biodiversity.

Having described above, it has been genetically confirmed for 10 species of Gobies as a constituent of the Nike fish assemblages in the Gorontalo Bay waters to date and it is possible to find more other species in line with further advancements in science and research. This study has been successfully grouping and identifying the species based on their morphometric and molecular characters, as well as being the initial identity of the melanophore pattern characters of each Nike fish compiler. These data are also very worthwhile as the reference for the inventory of Nike fish species in other places on the coast of Tomini Bay and other areas. Salam et al. (2016) stated that Nike fish assemblages in Gorontalo could be found in several *milango* (estuary areas). Besides being found in the estuary of the Bone Bolango River in Gorontalo, which is the location of this study, Nike fish assemblages also often appear in several estuary areas (i.e. Taludaa, Paguyaman, and Marisa). Nike fish caught at these locations are also consumed by the local community or sold in urban areas, making it one of the important fisheries commodities in Gorontalo. However, scientific information concerning Nike fish in these locations does not yet exist and should be sought as soon as possible. The results of this study can also be information for exploring adult gobies in the river and finding out their distribution in nature.

## ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Rector of Gorontalo State University for granting permission and supporting the accomplishment of this research. Also, the greatest gratitude goes to Mohamad Rusdiyanto Puluhalawa for the research fund. The authors

also thank Thomas Tammu and Zulkifli Karim for their technical assistance and all those who have contributed to this study. Finally, the authors thank the anonymous reviewers for their constructive input and contribution in improving the quality of this manuscript.

## REFERENCES

- Benbow ME, Burky AJ, Way CM. 2004. Morphological characteristics and species separation of Hawaiian postlarval amphidromous fishes. *Micronesica* 37 (1): 129-144.
- Bingpeng X, Heshan L, Zhilan Z, Chunguang W, Yanguo W, Jianjun W. 2018. DNA barcoding for identification of fish species in the Taiwan Strait. *PLoS One* 13 (6): e0198109. DOI: 10.1371/journal.pone.0198109.
- Dahrudin H, Utama A, Busson F, Sauri S, Hanner R, Keith P, Hadiaty R, Hubert N. 2016. Revisiting the ichthyodiversity of Java and Bali through DNA barcodes: taxonomic coverage, identification accuracy, cryptic diversity and identification of exotic species. *Mol Ecol Resour* 17 (2): 1-12.
- Ellien C, Werner U, Keith P. 2014. Morphological changes during the transition from freshwater to seawater in an amphidromous goby, *Sicyopterus lagocephalus* (Pallas 1770) (Teleostei). *Ecol Freshw Fish* 25 (1): 1-12. DOI: 10.1111/eff.12190.
- Elliott NG, Haskard K, Koslow JA. 1995. Morphometric analysis of orange roughy (*Hoplostethus atlanticus*) off the continental slope of southern Australia. *J Fish Biol* 46 (2): 202-220.
- Firawati I, Murwantoko, Setyobudi E. 2017. Morphological and molecular characterization of hairtail (*Trichiurus* spp.) from the Indian Ocean, southern coast of East Java, Indonesia. *Biodiversitas* 18 (1): 190-196.
- Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R. 1994. DNA primers for amplification of mitochondrial Cytochrome C Oxidase subunit I from diverse metazoan invertebrates. *Mol Mar Biol and Biotechnol* 3 (5): 294-299.
- Gani A, Bakri AA, Adriany DT, Nurjirana N, Herjayanto M, Bungalim MI, Ndobe S, Burhanuddin AI. 2019. Identification of freshwater goby species from The Biak and Koyuan Rivers, Luwuk Banggai, Central Sulawesi. *J Ilmu Kel Spermonde* 5 (2): 57-60.
- Habibie SA, Djumanto, Murwantoko. 2018. Polikromatik, dimorfisme seksual, dan redeskripsi spesies ikan red devil *Amphilophus amarillo* [Stauffer & McKaye, 2002] di Waduk Sermo Yogyakarta. *J Iktiologi Indones* 18 (1): 69-86. [Indonesian]
- Hubert N, Hanner R, Holm E, Mandrak NE, Taylor E, Burrige M, Watkinson D, Dumont P, Curry A, Bentzen P, Zhang J, April J, Bernatchez L. 2008. Identifying Canadian freshwater fishes through DNA barcodes. *PLoS One* 3(6): e2490. DOI: 10.1371/journal.pone.0002490.
- Hubert N, Kadarusman, Wibowo A, Busson F, Caruso D, Sulandari S, Nafiqoh N, Poiyaud L, Ruber L, Avarre JC, Herder F, Hanner R, Keith P, Hadiaty RK. 2015. DNA Barcoding Indonesian freshwater fishes: challenges and prospects. *DNA Barcodes* 3: 144-169.
- Ivanova NV, Zemlak TS, Hanner RH, Hebert PDN. 2007. Universal primer cocktails for fish DNA barcoding. *Mol Ecol Notes* 7(4): 544-548.
- Jeon HB, Choi SH, Suk HY. 2012. Exploring the utility of partial cytochrome c oxidase subunit I for DNA barcoding of gobies. *Anim Syst Evol Divers* 28 (4): 269-278.
- Jin X, Wang R, Wei T, Tang D, Xu T. 2014. Complete mitochondrial genome sequence of *Tridentiger bifasciatus* and *Tridentiger barbatus* (Perciformes, Gobiidae): a mitogenomic perspective on the phylogenetic relationships of Gobiidae. *Mol Biol Rep* 42: 253-265.
- Keith P. 2003. Biology and ecology of amphidromous Gobiidae of the Indo-Pacific and the Caribbean regions. *J Fish Biol* 63: 831-847.
- Keith P, Galewski T, Cattaneo-Berrebi G, Hoareau T, Berrebi P. 2005. Ubiquity of *Sicyopterus lagocephalus* (Teleostei: Gobioidae) and phylogeography of the genus *Sicyopterus* in the Indo-Pacific area inferred from mitochondrial cytochrome b gene. *Mol Phylogenet Evol* 37: 721-732.
- Keith P, Hoareau TB, Lord C, Ah-Yane O, Gimonneau G, Robinet T, Valade P. 2008. Characterisation of post-larval to juvenile stages, metamorphosis and recruitment of an amphidromous goby, *Sicyopterus lagocephalus* (Pallas) (Teleostei: Gobiidae: Sicydiinae). *Mar Freshwater Res* 59: 876-889.
- Keith P, Lord C, Lorion J, Watanabe S, Tsukamoto K, Couloux A, Dettai A. 2011. Phylogeny and biogeography of Sicydiinae (Teleostei: Gobiidae) inferred from mitochondrial and nuclear genes. *Mar Biol* 158: 311-326.
- Keith P, Lord C, Busson F, Sauri S, Hubert N, Hadiaty RK. 2015. A new species of *Sicyopterus* (Gobiidae) from Indonesia. *Cybius* 39 (4): 243-248.
- Landau S, Everit BS. 2004. A Handbook of Statistical Analyses using SPSS. Chapman & Hall/CRC, Washington DC.
- Larmuseau MHD, Vancampenhout K, Raeymaekers JAM, Houdt JKI, Volckaert FAM. 2010. Differential modes of selection on the rhodopsin gene in coastal Baltic and North Sea populations of the sand goby, *Pomatoschistus minutus*. *Mol Ecol* 19 (11): 2256-2268.
- Lejeune L, Tabouret H, Taillebois L, Monti D, Keith P. 2016. Larval traits of the Caribbean amphidromous goby *Sicydium punctatum* (Gobioidae: Sicydiinae) in Guadeloupe. *Ecol Freshw Fish* 25 (2): 272-280.
- Linh NM, Thu PT, Quan NV, Chien PV, Ly DH, Nhan DV, Len DT. 2018. DNA barcoding application of mitochondrial COI gene to identify some fish species of family Gobiidae in Vietnam. *J Mar Sci Tech-Japan* 18 (4): 433-451.
- Lord C, Bellec L, Dettai A, Bonillo C, Keith P. 2019. Does your lipstick? Evolutionary aspects of the mouth morphology of the Indo-Pacific clinging goby of the *Sicyopterus* genus (Teleostei: Gobioidae: Sicydiinae) based on mitogenome phylogeny. *J Zool Syst Evol Res* 2019;00: 1-16. DOI: 10.1111/jzs.12291.
- Maeda K, Tan HH. 2013. Review of *Stiphodon* (Gobiidae: Sicydiinae) from Western Sumatra, with Description of a New Species. *Raffles B Zool* 61 (2): 749-761.
- Mennesson MI, Maeda K, Keith P. 2019. Evolutionary aspects of cephalic sensory papillae of the Indo-Pacific species of *Eleotris* (Teleostei: Eleotridae). *Zool Scr* 48 (5): 627-639.
- Nurjirana, Burhanuddin AI, Haris A. 2019a. Diversity of penja fish (amphidromous goby) in Leppangan River, West Sulawesi, Indonesia. *AACL Bioflux* 12 (1): 246-249.
- Nurjirana, Haris A, Sahami FM, Keith P, Burhanuddin AI. 2019b. Preliminary note on the morphological characters of penja (amphidromous goby post larvae) in West Sulawesi and Gorontalo Bay. *IOP Conference Series: Earth and Environ Sci* 370 (1): 1-7.
- Oli AH, Sahami FM, Hamzah SN, Pasisingi N. 2017. Preliminary findings on distribution pattern of larvae of nike fish (*Awaous* sp.) in the estuary of Bone River, Gorontalo Province, Indonesia. *AACL Bioflux* 10: 1110-1118.
- Oli AH, Sahami FM, Hamzah SN, Pasisingi N. 2019. Molecular approach to identify gobioid fishes, "Nike" and "Hundala" (local name), from Gorontalo Waters, Indonesia. *Online J Biol Sci* 19 (1): 51-56.
- Pangemanan NP, Kepel RC, Bataragoa NE, Tumbol R, Sahami FM. 2020. Morphological and molecular identification of nike fish, *Ophioeleotris aporos* in Tondano Lake, North Sulawesi, Indonesia. *AACL Bioflux* 13 (3): 1614-1621.
- Pasisingi N, Abdullah S. 2018. Pola kemunculan ikan nike (Gobiidae) di Perairan Teluk Gorontalo, Indonesia. *Depik* 7 (2): 111-118. [Indonesian]
- Pasisingi N, Oli AH, Habibie SA. 2020a. Morphology and growth pattern of Nike fish (amphidromous goby larvae) in Gorontalo Waters, Indonesia. *Tomini J Aquat Sci* 1 (1): 1-7.
- Pasisingi N, Habibie SA, Oli AH. 2020b. Are *Awaous ocellaris* and *Belobranchius belobranchius* the two species of Nike fish schools?. *Aceh J Anim Sci* 5 (2): 87-91.
- Roesma DI, Tjong DH, Munir W, Aidil DR. 2018. New record species of *Puntius* (Pisces: Cyprinidae) from West Sumatra based on cytochrome oxidase I gene. *Intl J Adv Sci Eng Inf Technol* 8: 250-256.
- Roesma DI, Tjong DH, Karlina W, Aidil DR. 2019. Taxonomy confirmation of *Puntius* cf. *binotatus* from Gunung Tujuh Lake, Jambi, Indonesia based on cytochrome oxidase-I (COI) gene. *Biodiversitas* 20 (1): 54-60.
- Roesma DI, Tjong DH, Aidil DR. 2020. Phylogenetic analysis of transparent gobies in three Sumatran lakes, inferred from mitochondrial cytochrome oxidase I (COI) gene. *Biodiversitas* 21 (1): 43-48.
- Rukmana RM, Trijoko, Pratiwi R. 2014. Keragaman ikan anggota ordo perciformes di Sungai Sukamade Taman Nasional Meru Betiri. *Biomedika* 7 (2): 46-52. [Indonesian]

- Sahami FM, Kepel RC, Olii AH, Pratasik SB. 2019a. Determination of morphological alteration based on molecular analysis and melanophore pattern of the migrating Nike fish in Gorontalo Bay, Indonesia. *AACL Bioflux* 12 (4): 1358-1365.
- Sahami FM, Kepel RC, Olii AH, Pratasik SB. 2019b. What species make up the Nike fish assemblages at the macrotidal estuary in Gorontalo Bay, Indonesia? [version 1; peer review: 2 approved with reservation]. *F1000Research* 8: 1654. DOI: 10.12688/f1000research.19501.1.
- Salam A, Sahami FM, Panigoro C. 2016. Nike (*Awaous melanocephalus*) fishery and mercury contamination in the estuary of Bone-Bolango River. *Omni-Akuatika* 12 (2): 130-136.
- Sara L, Muskita WH, Astuti O, Safilu. 2016. The reproductive biology of blue swimming crab *Portunus pelagicus* in Southeast Sulawesi Waters, Indonesia. *AACL Bioflux* 9 (5): 1101-1112.
- Strüder-Kypke M, Lynn DH. 2010. Comparative analysis of the mitochondrial cytochrome c oxidase subunit I (COI) gene in ciliates (Alveolata, Ciliophora) and evaluation of its suitability as a biodiversity marker. *System Biodivers* 8 (1): 131-148.
- Taillebois L, Maeda K, Vigne S, Keith P. 2012. Pelagic larval duration of three amphidromous Sicydiinae gobies (Teleostei: Gobioidae) including widespread and endemic species. *Ecol Freshw Fish* 21 (4): 1-8. DOI: 10.1111/j.1600-0633.2012.00575.x.
- Taillebois L, Castelin M, Lord C, Chabarria R, Dettai A, Keith P. 2014. New sicydiinae phylogeny (Teleostei: Gobioidae) inferred from mitochondrial and nuclear genes: insights on systematics and ancestral areas. *Mol Phylogenet and Evol* 70: 260-271.
- Teletchea F. 2009. Molecular identification methods of fish species: reassessment and possible applications. *Rev Fish Biol Fish* 19: 265-293.
- Thacker CE, Roje DM. 2011. Phylogeny of Gobiidae and identification of gobiid lineages. *System Biodivers* 9 (4): 329-347.
- Thomas Jr RC, Beldia III PD, Campos WL, Santos MD. 2013. Resolving the identity of larval fishes, Dulong, in the Verde Island Passages. Philippines. *Phil J of Nat* 18: 29-36.
- Tjakrawidjaja AH. 2002. Jenis ikan air tawar dari Manggarai, Flores, dengan variasi aspek limnologinya. *J Iktiologi Indones* 2 (2): 15-22.
- Usman MY. 2016. Analisis Variasi Genetik Ikan Penja Indigenous Perairan Polewali Mandar Sulawesi Barat dan Ikan Nike (*Awaous* sp.) Indigenous Perairan Gorontalo. [Thesis]. UIN Alauddin Makassar, Makassar. [Indonesian]
- Valade P, Lord C, Grondin H, Bosc P, Taillebois L, Iida M, Tsukamoto K, Keith P. 2009. Early life history and description of larval stages of an amphidromous goby, *Sicyopterus lagocephalus* (Gobioidae: Sicydiinae). *Cybio* 33 (4): 309-319.
- Viswambharan D, Pavan-Kumar A, Singh DP, Jaiswar AK, Chakraborty SK, Nair JR, Lakra WS. 2013. DNA barcoding of gobiid fishes (Perciformes, Gobioidae). *Mitochondrial DNA* 26 (1): 15-19.
- Wang ZD, Liao J, Huang CQ, Long SS, Zhang S, Guo YS, Liu L, Liu CW. 2017. Significant genetic differentiation of *Gobiopertus lacustris*, a newly recorded transparent goby in China. *Mitochondrial DNA Part A*: 1-7. DOI: 10.1080/24701394.2017.1357712.
- Watanabe S, Iida M, Hagihara S, Endo H, Matsuura K, Tsukamoto K. 2011. First collection of amphidromous goby post-larvae of *Sicyopterus japonicus* in the ocean off Shikoku, Japan. *Cybio* 35 (4): 371-379.
- Watson RE. 2008. A new species of *Stiphodon* from southern Sumatra (Pisces: Gobioidae: Sicydiinae). *Zootaxa* 1715: 43-56.
- Yamasaki N, Kondo M, Maeda K, Tachihara K. 2011. Reproductive biology of three amphidromous gobies, *Sicyopterus japonicus*, *Awaous melanocephalus*, and *Stenogobius* sp., on Okinawa Island. *Cybio* 35 (4): 345-360.
- Yokoo T, Kanou K, Moteki M, Kohno H, Tongnunui P, Kurokura H. 2011. Assemblage structures and spatial distributions of small gobioid fishes in a mangrove estuary, southern Thailand. *Fish Sci* 78: 237-247.

Front cover: *Leucopsar rothschildi* Stresemann, 1912  
(PHOTO: SHEAU TORNG LIM)

---

Published monthly

PRINTED IN INDONESIA

ISSN: 1412-033X

E-ISSN: 2085-4722



9 771412 033818



9 772085 472812



ISSN: 1412-033X  
E-ISSN: 2085-4722

# BIODIVERSITAS

**Journal of Biological Diversity**

Volume 21 - Number 10 - October 2020



# BIODIVERSITAS

Journal of Biological Diversity  
Volume 21 – Number 10 – October 2020

ISSN/E-ISSN:

1412-033X (printed edition), 2085-4722 (electronic)

## EDITORIAL BOARD:

**Abdel Fattah N.A. Rabou** (Palestine), **Agnieszka B. Najda** (Poland), **Ajay Kumar Gautam** (India), **Alan J. Lymbery** (Australia), **Annisa** (Indonesia), **Bambang H. Saharjo** (Indonesia), **Daiane H. Nunes** (Brazil), **Darlina Md. Naim** (Malaysia), **Ghulam Hassan Dar** (India), **Hassan Pourbabaei** (Iran), **Joko R. Witono** (Indonesia), **Kartika Dewi** (Indonesia), **Katsuhiko Kondo** (Japan), **Kusumadewi Sri Yulita** (Indonesia), **Livia Wannorp** (Sweden), **M. Jayakara Bhandary** (India), **Mahdi Reyahi-Khoram** (Iran), **Mahendra K. Rai** (India), **Mahesh K. Adhikari** (Nepal), **Maria Panitsa** (Greece), **Mochamad A. Soendjoto** (Indonesia), **Mohib Shah** (Pakistan), **Mohamed M.M. Najim** (Srilanka), **Nurhasanah** (Indonesia), **Praptiwi** (Indonesia), **Rasool B. Tareen** (Pakistan), **Sayed Aliakbar Hedayati** (Iran), **Sayed Mehdi Talebi** (Iran), **Shahabuddin** (Indonesia), **Shahir Shamsir** (Malaysia), **Shri Kant Tripathi** (India), **Subhash C. Santra** (India), **Sugeng Budiharta** (Indonesia), **Sugiyarto** (Indonesia), **Taufiq Purna Nugraha** (Indonesia), **Yosep S. Mau** (Indonesia)

## EDITOR-IN-CHIEF:

**S u t a r n o**

## EDITORIAL MEMBERS:

English Editors: **Graham Eagleton** (grahameagleton@gmail.com), **Suranto** (surantouns@gmail.com); Technical Editor: **Solichatun** (solichatun\_s@yahoo.com), **Artini Pangastuti** (pangastuti\_tutut@yahoo.co.id); Distribution & Marketing: **Rita Rakhmawati** (oktia@yahoo.com); Webmaster: **Ari Pitoyo** (aripitoyo@yahoo.com)

## MANAGING EDITORS:

**Ahmad Dwi Setyawan** (unsjournals@gmail.com)

## PUBLISHER:

The Society for Indonesian Biodiversity

## CO-PUBLISHER:

Department of Biology, Faculty of Mathematics and Natural Sciences, Sebelas Maret University, Surakarta

## ADDRESS:

Jl. Ir. Sutami 36A Surakarta 57126. Tel. +62-271-7994097, Tel. & Fax.: +62-271-663375, email: editors@smujo.id

## ONLINE:

biodiversitas.mipa.uns.ac.id; smujo.id/biodiv

.....



**Society for Indonesia  
Biodiversity**



**Sebelas Maret University  
Surakarta**

## GUIDANCE FOR AUTHORS

**Aims and Scope** *Biodiversitas*, *Journal of Biological Diversity* or abbreviated as *Biodiversitas* encourages submission of manuscripts dealing with all biodiversity aspects of plants, animals and microbes at the level of the gene, species, and ecosystem as well as ethnobiology.

**Article types** The journal seeks original full-length research papers, reviews, and short communication. Manuscript of original research should be written in no more than 8,000 words (including tables and picture), or proportional with articles in this publication number. Review articles will be accommodated, while, short communication should be written at least 2,000 words, except for pre-study.

**Submission** The journal only accepts online submission, through open journal system (<https://smujo.id/biodiv/about/submissions>) or email to the editors at [unsjournals@gmail.com](mailto:unsjournals@gmail.com). Submitted manuscripts should be the original works of the author(s). The manuscript must be accompanied by a cover letter containing the article title, the first name and last name of all the authors, a paragraph describing the claimed novelty of the findings versus current knowledge. Submission of a manuscript implies that the submitted work has not been published before (except as part of a thesis or report, or abstract); and is not being considered for publication elsewhere. When a manuscript written by a group, all authors should read and approve the final version of the submitted manuscript and its revision; and agree the submission of manuscripts for this journal. All authors should have made substantial contributions to the concept and design of the research, acquisition of the data and its analysis; drafting of the manuscript and correcting of the revision. All authors must be responsible for the quality, accuracy, and ethics of the work.

**Ethics** Author(s) must obedient to the law and/or ethics in treating the object of research and pay attention to the legality of material sources and intellectual property rights.

**Copyright** If and when the manuscript is accepted for publication, the author(s) still hold the copyright and retain publishing rights without restrictions. Authors or others are allowed to multiply article as long as not for commercial purposes. For the new invention, authors are suggested to manage its patent before published.

**Open access** The journal is committed to free-open access that does not charge readers or their institutions for access. Readers are entitled to read, download, copy, distribute, print, search, or link to the full texts of articles, as long as not for commercial purposes. The license type is CC-BY-NC-SA.

**Acceptance** The only articles written in English (U.S. English) are accepted for publication. Manuscripts will be reviewed by editors and invited reviewers(double blind review) according to their disciplines. Authors will generally be notified of acceptance, rejection, or need for revision within 1 to 2 months of receipt. The manuscript is rejected if the content does not in line with the journal scope, does not meet the standard quality, inappropriate format, complicated grammar, dishonesty (i.e. plagiarism, duplicate publications, fabrication of data, citations manipulation, etc.), or ignoring correspondence in three months. The primary criteria for publication are scientific quality and biodiversity significance. **Uncorrected proofs** will be sent to the corresponding author by email as .doc or .docx files for checking and correcting of typographical errors. To avoid delay in publication, corrected proofs should be returned in 7 days. The accepted papers will be published online in a chronological order at any time, but printed in the early of each month (12 times).

**A charge** Starting on January 1, 2019, publishing costs waiver is granted to authors of graduate students from **Least Developed Countries**, who first publish the manuscript in this journal. However, other authors are charged USD 250 (IDR 3,500,000). Additional charges may be billed for language editing, USD 75-150 (IDR 1,000,000-2,000,000).

**Reprints** The sample journal reprint is only available by special request. Additional copies may be purchased when ordering by sending back the uncorrected proofs by email.

**Manuscript preparation** Manuscript is typed on A4 (210x297 mm<sup>2</sup>) paper size, in a single column, single space, 10-point (10 pt) Times New Roman font. The margin text is 3 cm from the top, 2 cm from the bottom, and 1.8 cm from the left and right. Smaller lettering size can be applied in presenting table and figure (9 pt). Word processing program or additional software can be used, however, it must be PC compatible and Microsoft Word based (.doc or .rtf, not .docx). **Scientific names** of species (incl. subspecies, variety, etc.) should be written in italic, except for italic sentence. Scientific name (genera, species, author), and cultivar or strain should be mentioned completely for the first time mentioning it in the body text, especially for taxonomic manuscripts. Name of genera can be shortened after first mentioning, except generating confusion. Name of the author can be eliminated after first mentioning. For example, *Rhizopus oryzae* L. UICC 524, hereinafter can be written as *R. oryzae* UICC 524. Using trivial name should be avoided, otherwise generating confusion. **Biochemical and chemical nomenclature** should follow the order of the IUPAC - IUB. For DNA sequence, it is better used Courier New font. Symbols of standard chemical and abbreviation of chemistry name can be applied for common and clear used, for example, completely written butilic hydroxyl toluene (BHT) to be BHT hereinafter. **Metric measurement** use IS denomination, usage other system should follow the value of equivalent with the denomination of IS first mentioning. Abbreviations set of, like g, mg, mL, etc. do not follow by dot. Minus index (m<sup>-2</sup>, L<sup>-1</sup>, h<sup>-1</sup>) suggested to be used, except in things like "per-plant" or "per-plot". **Equation of mathematics** does not always can be written

down in one column with text, in that case can be written separately. **Number** one to ten are expressed with words, except if it relates to measurement, while values above them written in number, except in early sentence. The fraction should be expressed in decimal. In the text, it should be used "%" rather than "percent". Avoid expressing ideas with complicated sentence and verbiage, and used efficient and effective sentence.

**Title** of the article should be written in compact, clear, and informative sentence, preferably not more than 20 words. Name of author(s) should be completely written. **Name and institution** address should also be completely written with street name and number (location), postal code, telephone number, facsimile number, and email address. Manuscript written by a group, author for correspondence along with address is required. First page of the manuscript is used for writing above information.

**Abstract** should not be more than 200 words. **Keywords** is about five words, covering scientific and local name (if any), research theme, and special methods which used; and sorted from A to Z. All important **abbreviations** must be defined at their first mention. **Running title** is about five words. **Introduction** is about 400-600 words, covering the background and aims of the research. **Materials and Methods** should emphasize on the procedures and data analysis. **Results and Discussion** should be written as a series of connecting sentences, however, for manuscript with long discussion should be divided into subtitles. Thorough discussion represents the causal effect mainly explains for why and how the results of the research were taken place, and do not only re-express the mentioned results in the form of sentences. **Concluding** sentence should be given at the end of the discussion. **Acknowledgments** are expressed in a brief; all sources of institutional, private and corporate financial support for the work must be fully acknowledged, and any potential conflicts of interest are noted.

**Figures and Tables** of maximum of three pages should be clearly presented. Title of a picture is written down below the picture, while title of a table is written above the table. Colored figures can only be accepted if the information in the manuscript can lose without those images; chart is preferred to use black and white images. Author could consign any picture or photo for the front cover, although it does not print in the manuscript. All images property of others should be mentioned source. **There is no appendix**, all data or data analysis are incorporated into Results and Discussions. For broad data, it can be displayed on the website as a supplement.

**References** Author-year citations are required. In the text give the authors name followed by the year of publication and arrange from oldest to newest and from A to Z. In citing an article written by two authors, both of them should be mentioned, however, for three and more authors only the first author is mentioned followed by et al., for example: Saharjo and Nurhayati (2006) or (Boonkerd 2003a, b, c; Sugiyarto 2004; El-Bana and Nijs 2005; Balagadde et al. 2008; Webb et al. 2008). Extent citation as shown with word "cit" should be avoided. Reference to unpublished data and personal communication should not appear in the list but should be cited in the text only (e.g., Rifai MA 2007, pers. com. (personal communication); Setyawan AD 2007, unpublished data). In the reference list, the references should be listed in an alphabetical order (better, if only 20 for research papers). Names of journals should be abbreviated. Always use the standard abbreviation of a journal's name according to the **ISSN List of Title Word Abbreviations** ([www.issn.org/2-22661-LTWA-online.php](http://www.issn.org/2-22661-LTWA-online.php)). The following examples are for guidance.

### Journal:

Saharjo BH, Nurhayati AD. 2006. Domination and composition structure change at hemic peat natural regeneration following burning; a case study in Pelalawan, Riau Province. *Biodiversitas* 7: 154-158.

### Book:

Rai MK, Carpinella C. 2006. Naturally Occurring Bioactive Compounds. Elsevier, Amsterdam.

### Chapter in book:

Webb CO, Cannon CH, Davies SJ. 2008. Ecological organization, biogeography, and the phylogenetic structure of rainforest tree communities. In: Carson W, Schnitzer S (eds) *Tropical Forest Community Ecology*. Wiley-Blackwell, New York.

### Abstract:

Assaad AM. 2007. Seed production and dispersal of *Rhazya stricta*. 50<sup>th</sup> annual symposium of the International Association for Vegetation Science, Swansea, UK, 23-27 July 2007.

### Proceeding:

Alikodra HS. 2000. Biodiversity for development of local autonomous government. In: Setyawan AD, Sutarno (eds.) *Toward Mount Lawu National Park; Proceeding of National Seminary and Workshop on Biodiversity Conservation to Protect and Save Germplasm in Java Island*. Universitas Sebelas Maret, Surakarta, 17-20 July 2000. [Indonesian]

### Thesis, Dissertation:

Sugiyarto. 2004. Soil Macro-invertebrates Diversity and Inter-Cropping Plants Productivity in Agroforestry System based on Sengon. [Dissertation]. Universitas Brawijaya, Malang. [Indonesian]

### Information from internet:

Balagadde FK, Song H, Ozaki J, Collins CH, Barnet M, Arnold FH, Quake SR, You L. 2008. A synthetic *Escherichia coli* predator-prey ecosystem. *Mol Syst Biol* 4: 187. [www.molecularsystemsbiology.com](http://www.molecularsystemsbiology.com)

**THIS PAGE INTENTIONALLY LEFT BLANK**