

PEER REVIEW

**LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : JURNAL ILMIAH**

Judul Jurnal Ilmiah (Artikel) : Prevalence and diversity of ectoparasites in scavenging chickens (Gallus domesticus) and their association to body weighth.

Penulis Jurnal Ilmiah *) : 1 Edy Riwidiharso (*nama pengusul dicetak tebal)
2 Darsono
3 Endang Ariyani Seyowati
4 Hery Pratiknyo
5 **Eming Sudiana**
6 Slamet Santoso
7 Edy Yani
8 Imam Widhiono

Jumlah Penulis : 8

Status Penulis : Penulis Ke-5

Identitas Jurnal Ilmiah :
a. Nama Jurnal : BIODIVERSITAS Journal of Biological Diversity
b. Nomor ISSN : ISSN: P-1412-033x E-ISSN: 2085-4722
c. Edisi/Volume, Nomor : Edisi Juli 2020/Vol. 21 Nomor : 7
d. Penerbit : Department of Biology, FMNS, Universitas Sebelas
e. DOI artikel : <https://doi.org/10.13057/biodiv/d210738>
f. Alamat Web : <https://smujo.id/biodiv/article/view/5850>
g. Terindeks di : SCOPUS, Q3, SJR : 0,27

Kategori Publikasi Jurnal Ilmiah : Jurnal Ilmiah Internasional /Internasional Bereputasi
(beri v pada kategori yang tepat) Jurnal Ilmiah Nasional Terakreditasi
 Jurnal Nasional/Nasional terindeks di..... *

Hasil Penilaian Peer Review :

Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah			Nilai Akhir Yang Diperoleh
	Internasional/ Internasional bereputasi	Nasional Terakreditasi	Nasional Terindeks *)	
	<input type="text" value="40"/>	<input type="text"/>	<input type="text"/>	
a Kelengkapan unsur isi artikel (10%)	10 % X 40= 4			3.9
b Ruang lingkup dan kedalaman pembahasan (30%)	30 % X 40= 12			11.8
c Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	30 % X 40= 12			11.8
d Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	30 % X 40= 12			11.8
Total = (100%)	40			39.2
Nilai Pengusul (40 % x Total)/7	2.29			2.24

Catatan Penilaian artikel oleh Reviewer:

1. Tentang kelengkapan dan kesesuaian unsur : Lengkap & sesuai unsur
2. Tentang ruang lingkup dan kedalaman pembahasan : Baik & parameter dibahas mendalam Ruang Lingkup & Mendalam
3. Kecukupan dan kemutahiran data serta metodologi : Data cukup & metodologi mutahir
4. Kelengkapan unsur kualitas penerbit : Unsur lengkap, kualitas baik
5. Indikasi plagiasi : Tidak ada
6. Kesesuaian bidang ilmu : Sesuai

Purwokerto,

*) Wajib diisi

Reviewer 1

Dr. Dwi Nugroho Wibowo, M.S.
NIP. 196111251986011001
Jabatan/Gol. : Lektor Kepala/(Gol. IV/c)
Bidang Ilmu : Ekologi
Unit Kerja : Fakultas Biologi Unsoed

Reviewer 2

Dr. Suhestri Suryaningsih, M.S.
NIP. 195703101984031002
Jabatan/Gol. : Lektor Kepala/(Gol. IV/c)
Bidang Ilmu : Taksonomi Vertebrata
Unit Kerja : Fakultas Biologi Unsoed

LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : JURNAL ILMIAH

Judul Jurnal Ilmiah (Artikel) : Prevalence and diversity of ectoparasites in scavenging chickens (Gallus domesticus) and their association to body weight.

Penulis Jurnal Ilmiah *) : 1 Edy Riwidiharso (*nama pengusul dicetak tebal)
2 Darsono
3 Endang Ariyani Seyowati
4 Hery Pratiknyo
5 **Eming Suidiana**
6 Slamet Santoso
7 Edy Yani
8 Imam Widhiono

Jumlah Penulis : 8

Status Penulis : Penulis Ke-5

Identitas Jurnal Ilmiah :
a. Nama Jurnal : BIODIVERSITAS Journal of Biological Diversity
b. Nomor ISSN : ISSN: P-1412-033x E-ISSN: 2085-4722
c. Edisi/Volume, Nomor : Edisi Juli 2020/Vol. 21 Nomor : 7
d. Penerbit : Department of Biology, FMNS, Universitas Sebelas Maret Surakarta
e. DOI artikel : https://doi.org/10.13057/biodiv/d210738
f. Alamat Web : https://smujo.id/biodiv/article/view/5850
g. Terindeks di : SCOPUS, Q3, SJR : 0,27

Kategori Publikasi Jurnal Ilmiah : Jurnal Ilmiah Internasional /Internasional Bereputasi
(beri v pada kategori yang tepat) Jurnal Ilmiah Nasional Terakreditasi
 Jurnal Nasional/Nasional terindeks di..... *

Hasil Penilaian Peer Review :

Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah			Nilai Akhir Yang Diperoleh
	Internasional/ Internasional bereputasi 40	Nasional Terakreditasi	Nasional *)	
a Kelengkapan unsur isi artikel (10%)	10 % X 40= 4			3,0
b Ruang lingkup dan kedalaman pembahasan (30%)	30 % X40= 12			11,7
c Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	30 % X40= 12			11,7
d Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	30 % X40= 12			11,7
Total = (100%)	40			39
Nilai Pengusul (40 % x Total)/7	2.29			2,23

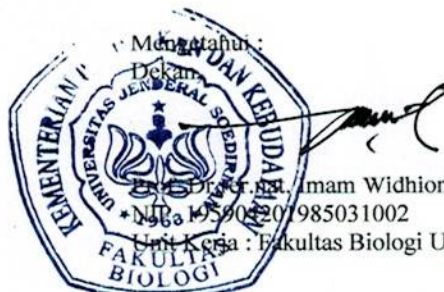
Catatan Penilaian artikel oleh Reviewer:

- 1. Tentang kelengkapan dan kesesuaian unsur : LENGKAP & SESUAI UKUR
- 2. Tentang ruang lingkup dan kedalaman pembahasan : BAK & CUKUP DALAM ASPEK PEMBAHASAN
- 3. Kecukupan dan kemutahiran data serta metodologi : CUKUP & DATA METODOLOGI MUTAKHIR
- 4. Kelengkapan unsur kualitas penerbit : LENGKAP
- 5. Indikasi plagiasi : TIDAK ADA
- 6. Kesesuaian bidang ilmu : SESUAI

Purwokerto, 12 OCT 2020 *) wajib diisi

Reviewer 1

Dr. Dwi Nugroho Wibowo, M.S.
NIP. 196111251986011001
Jabatan/Gol. : Lektor Kepala/(Gol. IV/c)
Bidang Ilmu : Ekologi
Unit Kerja : Fakultas Biologi Unsoed



Mengetahui :
Dekan : Imam Widhiono M.Z., M.S.
NIP. 195903201985031002
Unit Kerja : Fakultas Biologi Unsoed

AG

**LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : JURNAL ILMIAH**

Judul Jurnal Ilmiah (Artikel) : Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight.

Penulis Jurnal Ilmiah *) : 1 Edy Riwidiharso (*nama pengusul dicetak tebal)
2 Darsono
3 Endang Ariyani Seyowa
4 Hery Pratiknyo
5 **Eming Sudiana**
6 Slamet Santoso
7 Edy Yani
8 Imam Widhiono

Jumlah Penulis : 8

Status Penulis : Penulis Ke-5

Identitas Jurnal Ilmiah :

a. Nama Jurnal : BIODIVERSITAS Journal of Biological Diversity
b. Nomor ISSN : ISSN: P-1412-033x E-ISSN: 2085-4722
c. Edisi/Volume, Nomor : Edisi Juli 2020/Vol. 21 Nomor : 7
d. Penerbit : Department of Biology, FMNS, Universitas Sebelas Maret Surakarta
e. DOI artikel : <https://doi.org/10.13057/biodiv/d210738>
f. Alamat Web : <https://smujo.id/biodiv/article/view/5850>
g. Terindeks di : SCOPUS, Q3, SJR : 0,27

Kategori Publikasi Jurnal Ilmiah : Jurnal Ilmiah Internasional /Internasional Bereputasi
(beri v pada kategori yang tepat) Jurnal Ilmiah Nasional Terakreditasi
 Jurnal Nasional/Nasional terindeks di..... *

Hasil Penilaian Peer Review :

Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah			Nilai Akhir Yang Diperoleh
	Internasional/ Internasional bereputasi 40	Nasional Terakreditasi	Nasional *)	
a Kelengkapan unsur isi artikel (10%)	10 % X 40= 4			3,9
b Ruang lingkup dan kedalaman pembahasan (30%)	30 % X 40= 12			11,9
c Kecukupan dan kemutakhiran data/informasi dan metodologi (30%)	30 % X 40= 12			11,8
d Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	30 % X 40= 12			11,8
Total = (100%)	40			39,4
Nilai Pengusul (40 % x Total)/7	2,29			2,25

Catatan Penilaian artikel oleh Reviewer:

1. Tentang kelengkapan dan kesesuaian unsur : *Lengkap, sesuai*
2. Tentang ruang lingkup dan kedalaman pembahasan : *Ruang lingkup & parameter dibahas mendalam*
3. Kecukupan dan kemutakhiran data serta metodologi : *Data cukup & metodologi mutakhir*
4. Kelengkapan unsur kualitas penerbit : *Unsur lengkap, kualitas baik*
5. Indikasi plagiasi : *Tidak ada*
6. Kesesuaian bidang ilmu : *Sesuai*

Purwokerto,

*) wajib diisi

Reviewer 2




Dr. Suhestri Suryaningsih, M.S.
NIP. 195703101984031002
Jabatan/Gol. : Lektor Kepala/(Gol. IV/c)
Bidang Ilmu : Taksonomi Vertebrata
Unit Kerja : Fakultas Biologi Unsoed




Imam Widhiono M.Z, M.S.
NIP. 195904201985031002
Unit Kerja : Fakultas Biologi Unsoed

ARTIKEL

A petri dish containing a red agar medium. The top half of the dish shows several small, white, circular bacterial colonies. The bottom half of the dish is covered by a large, dense, white, fuzzy bacterial growth that has spread across the surface.

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

BIODIVERSITAS

Journal of Biological Diversity

Volume 21 - Number 7 - July 2020

Front cover: *Bacillus cereus*
(PHOTO: JOE RUBIN)

Published monthly

PRINTED IN INDONESIA

ISSN: 1412-033X

E-ISSN: 2085-4722



9 771412 033788



9 772085 472782

BIODIVERSITAS

Journal of Biological Diversity
Volume 21 – Number 7 – July 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 Pourbabaie** (Iran), **Joko R. Witono** (Indonesia), **Kartika Dewi** (Indonesia), **Katsuhiko Kondo** (Japan), **Kusumadewi Sri Yulita** (Indonesia), **Livia Wanntorp** (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), **Seyed Aliakbar Hedayati** (Iran), **Seyed 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. 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 mm²) 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⁻², L⁻¹, h⁻¹) 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). 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:

Assaed AM. 2007. Seed production and dispersal of *Rhazya stricta*. 50th 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

Home (<https://smujo.id/biodiv/index>) / Archives (<https://smujo.id/biodiv/issue/archive>)
/ Vol. 21 No. 7 (2020)



(<https://smujo.id/biodiv/issue/view/268>)

Vol. 21 No. 7 (2020)

Full Issue

Front Cover (<https://smujo.id/biodiv/issue/view/268/120>)

Articles

Isolation and selection of *Bacillus cereus* specific phages from hospital wastewater (<https://smujo.id/biodiv/article/view/5922>)

ANWAR ROVIK, SAEFUDDIN 'AZIZ, HENDRO PRAMONO

PDF (<https://smujo.id/biodiv/article/view/5922/3988>)

Floristic composition and vegetation community analysis of Gesha and Sayilem Forest in Kaffa Zone south western Ethiopia (<https://smujo.id/biodiv/article/view/5955>)

ADMASU ADDI, TESHOME SOROMESSA, TURA BAREKE

PDF (<https://smujo.id/biodiv/article/view/5955/3989>)

Detection of virulence and specific genes of *Salmonella* sp. indigenous from Jember, Indonesia (<https://smujo.id/biodiv/article/view/5634>)

RIA YULIAN, ERLIA NARULITA, MOCHAMMAD IQBAL, DESY ROCHMIYAH SARI, IRMA SURYANINGSIH, DIAN EKA APRILIA FITRIA NINGRUM

PDF (<https://smujo.id/biodiv/article/view/5634/3990>)

Spectral observation of agarwood by infrared spectroscopy: The differences of infected and normal *Aquilaria microcarpa* (<https://smujo.id/biodiv/article/view/5944>)

DANANG SUDARWOKO ADI, SUNG-WOOK HWANG, DWI AJIAS PRAMASARI, YUSUP AMIN, BERNADETA AYU WIDYANINGRUM, TEGUH DARMAWAN, ERIS SEPTIANA, WAHYU DWIANTO, JUNJI SUGIYAMA

PDF (<https://smujo.id/biodiv/article/view/5944/3991>)

The optimization of the Ambonese arrack fermentation using co-culture *Pichia polymorpha* and *Kloeckera javanica* (<https://smujo.id/biodiv/article/view/5991>)

FERYMON MAHULETTE, DEA INDRIANI ASTUTI

PDF (<https://smujo.id/biodiv/article/view/5991/3992>)

Short Communication: Diversity of culturable epiphytic bacteria isolated from seagrass (*Halodule uninervis*) in Thailand and their preliminary antibacterial activity (<https://smujo.id/biodiv/article/view/5743>)

PARIMA BOONTANOM, AIYA CHANTARASIRI

PDF (<https://smujo.id/biodiv/article/view/5743/3993>)

Ultrastructure characters and partial mtDNA-COI haplotypes of Asian corn borer, *Ostrinia furnacalis* (Guenée) (Lepidoptera: Crambidae) from Indonesia (<https://smujo.id/biodiv/article/view/5109>)

AHMAD TAUFIQ ARMINUDIN, SUPUTA, ARMAN WIJONARKO, Y. ANDI TRISYONO

PDF (<https://smujo.id/biodiv/article/view/5109/3996>)

Phenotypic diversity and plasticity index of *Eurycoma apiculata* populations in Eastern Sumatra, Indonesia based on leaves morphology (<https://smujo.id/biodiv/article/view/6044>)

ZULFAHMI, EDI PURWANTO, PARJANTO, AHMAD YUNUS

PDF (<https://smujo.id/biodiv/article/view/6044/3997>)

Evaluation of in vitro antagonistic activity of fungi from peatlands against *Ganoderma* species under acidic condition
(<https://smujo.id/biodiv/article/view/5705>)

SUPRIYANTO, PURWANTO, S.H. POROMARTO, SUPYANI

PDF (<https://smujo.id/biodiv/article/view/5705/3998>)

Habitat preference and spatial distribution model of threatened species *Saurauia microphylla* in Mt. Slamet, Central Java, Indonesia
(<https://smujo.id/biodiv/article/view/5793>)

HENDRA HELMANTO, NISYAWATI, IYAN ROBIANSYAH, RIZMOON NURUL
ZULKARNAEN, NABELA FIKRIYYA

PDF (<https://smujo.id/biodiv/article/view/5793/3999>)

Exploring entomopathogenic fungi from South Sumatra (Indonesia) soil and their pathogenicity against a new invasive maize pest, *Spodoptera frugiperda* (<https://smujo.id/biodiv/article/view/5823>)

SITI HERLINDA, NONI OCTARIATI, SUWANDI SUWANDI, HASBI

PDF (<https://smujo.id/biodiv/article/view/5823/4000>)

Short Communication: Phytochemical screening and toxicity of ethanol extract of *Sauropus androgynus*
(<https://smujo.id/biodiv/article/view/5925>)

AWALUDIN AWALUDIN, KARTINA KARTINA, DIANA MAULIANAWATI, WASMEN
MANALU, ANDRIYANTO ANDRIYANTO, RIKA SEPTIANA, AGUS ARFANDI, YUBAL
LALANG

PDF (<https://smujo.id/biodiv/article/view/5925/4007>)

Investigating new SNPs of CAST, CAPN and SCD genes in 5'UTR of Bali cattle (<https://smujo.id/biodiv/article/view/5371>)

JAKARIA, MOKHAMAD FAKHRUL ULUM, DEWI LESTARI, SAMUEL AKWILA, DIAN ERMA
WARU TIDOLF SIHITE, RUDY PRIYANTO, MULADNO, CECE SUMANTRI

PDF (<https://smujo.id/biodiv/article/view/5371/4006>)

Effectiveness of oral irrigation with an extract of green microalga *Nannochloropsis oculata* as an anti-inflammatory in rats infected with *Aggregatibacter actinomycetemcomitans*
(<https://smujo.id/biodiv/article/view/5651>)

SYAMSULINA REVIANTI, DWI ANDRIANI, KRISTANTI PARISIHNI, ENDAH WAHJUNINGSIH, WIDYASTUTI

PDF (<https://smujo.id/biodiv/article/view/5651/4008>)

Genome evaluation of banana cultivars based on morphological character and Inter-Simple Sequence Repeat (ISSR) molecular marker (<https://smujo.id/biodiv/article/view/5815>)

DIDIK WAHYUDI, USLAN, KHAFIDHOTUR RIFLIYAH

PDF (<https://smujo.id/biodiv/article/view/5815/4009>)

Variation in morphological traits of a selection of Indonesian winged bean accessions (*Psophocarpus tetragonolobus*) and its analysis to assess genetic diversity among accessions (<https://smujo.id/biodiv/article/view/5879>)

IZMI YULIANA, BUDI WALUYO, SUMERU ASHARI, KUSWANTO

PDF (<https://smujo.id/biodiv/article/view/5879/4010>)

Screening for probiotic of lactic acid bacteria isolated from the digestive tract of a native Aceh duck (*Anas platyrhynchos*) (<https://smujo.id/biodiv/article/view/5898>)

YAYUK KURNIA RISNA, SRI HARIMURTI, WIHANDOYO, WIDODO

PDF (<https://smujo.id/biodiv/article/view/5898/4015>)

Cross-ecosystem utilizing primed seeds of upland rice varieties for enriching crop diversity at riparian wetland during dry season (<https://smujo.id/biodiv/article/view/5942>)

ROFIQOH PURNAMA RIA, BENYAMIN LAKITAN, FIRDAUS SULAIMAN, KARTIKA KARTIKA, RUJITO AGUS SUWIGNYO

PDF (<https://smujo.id/biodiv/article/view/5942/4016>)

Short Communication: Egg harvesting and local conservation of Moluccan Scrubfowl (*Eulipoa wallacei*) in the Maluku Islands, Indonesia (<https://smujo.id/biodiv/article/view/5733>)

RADIOS SIMANJUNTAK, MASITAH YUSNIAR, YUNIUS M. SAMALUKANG, FIKTOR IMANUEL BOLEU, ANI MARDIASTUTI, VICENTIA WIDYASARI, JIHAD SULFANI UDIN

PDF (<https://smujo.id/biodiv/article/view/5733/4017>)

Vegetation structure and floristic composition of tree species in the habitat of *Scaphium macropodum* in Gunung Leuser National Park, Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/6134>)

ARIDA SUSILOWATI, DENI ELFIATI, HENTI HENDALSTUTI RACHMAT, KUSUMADEWI SRI YULITA, ADI NURUL HADI, YOSIE SYADZA KUSUMA, SRI ANJELI LUMBAN BATU

PDF (<https://smujo.id/biodiv/article/view/6134/4018>)

Assay optimization for measuring the alternate complement pathway activity in Asian seabass (*Lates calcarifer*) (<https://smujo.id/biodiv/article/view/5458>)

SRI D. HASTUTI, MARY D. BARTON, STEPHEN B. PYECROFT, MAURIZIO COSTABILE

PDF (<https://smujo.id/biodiv/article/view/5458/4019>)

Characterization and expression of Cm-AAT1 gene encoding alcohol acyl-transferase in melon fruit (*Cucumis melo* L.) 'Hikapel' (<https://smujo.id/biodiv/article/view/5534>)

WIKO ARIF WIBOWO, MUHAMMAD IMAM FATKHUROHMAN, BUDI SETIADI DARYONO

PDF (<https://smujo.id/biodiv/article/view/5534/4020>)

Aquatic insect assemblages in four urban lakes of Bogor, West Java, Indonesia (<https://smujo.id/biodiv/article/view/5855>)

WAKHID, AUNU RAUF, MAJARIANA KRISANTI, I MADE SUMERTAJAYA, NINA MARYANA

PDF (<https://smujo.id/biodiv/article/view/5855/4022>)

Prevalence naturally infected gastrointestinal parasites and complete blood count condition on Wonosobo sheep at Wonosobo District, Central Java, Indonesia (<https://smujo.id/biodiv/article/view/5985>)

ZEIN AHMAD BAIHAQI, WISNU NURCAHYO, IRKHAM WIDIYONO

PDF (<https://smujo.id/biodiv/article/view/5985/4023>)

Influence of siam weed compost on soybean varieties in an agroforestry system with kayu putih (*Melaleuca cajuputi*) (<https://smujo.id/biodiv/article/view/6072>)

PRIYONO SURYANTO, ENY FARIDAH, HANDOJO HADI NURJANTO, SUPRIYANTA, DODY KASTONO, EKA TARWACA SUSILA PUTRA, SUCI HANDAYANI, ANGGRAENI KUSUMA DEWI, TAUFAN ALAM

PDF (<https://smujo.id/biodiv/article/view/6072/4024>)

Short Communication: Identification and phylogenetic analysis of *Corynebacterium diphtheriae* isolates from Jakarta, Indonesia based on partial *rpoB* gene (<https://smujo.id/biodiv/article/view/5165>)

ANDI YASMON, YEVA ROSANA, DONI USMAN, LUH INTA PRILANDARI, TEGUH SARRY HARTONO

PDF (<https://smujo.id/biodiv/article/view/5165/4025>)

Impact of mycoinsecticides and abamectin applications on species diversity and abundance of aquatic insects in rice fields of freshwater swamps of South Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/5811>)

SITI HERLINDA, MONICA ALESIA, SUSILAWATI, CHANDRA IRSAN, HASBI, SUPARMAN, ERISE ANGGRAINI, ARSI

PDF (<https://smujo.id/biodiv/article/view/5811/4026>)

Diversity of endophytic and rhizosphere bacteria from pineapple (*Ananas comosus*) plant in semi-arid ecosystem (<https://smujo.id/biodiv/article/view/5903>)

RAHAYU FITRIANI WANGSA PUTRIE, I NYOMAN PUGEG ARYANTHA, IRIAWATI, SARJIYA ANTONIUS

PDF (<https://smujo.id/biodiv/article/view/5903/4027>)

Morphological variations of mangosteen fruits from Luzon and Mindanao Islands, the Philippines (<https://smujo.id/biodiv/article/view/5623>)

J. BERAME, N. LAWSIN, F. MIGUEL, J. CHAVEZ

PDF (<https://smujo.id/biodiv/article/view/5623/4028>)

Environmental factors and seasonal effect on the potential harmful algae presence at Ambon Bay, Indonesia (<https://smujo.id/biodiv/article/view/5951>)

MOHAMMAD MAHMUDI, EVELLIN DEWI LUSIANA, ENDANG Y. HERAWATI, LUKAS G. SERIHOLLO

PDF (<https://smujo.id/biodiv/article/view/5951/4029>)

Tolerance and determinants of drought character descriptors of the Madurese landrace bambara groundnut (*Vigna subterranea*) (<https://smujo.id/biodiv/article/view/5322>)

SITI FATIMAH, ARIFFIN, ARDIARINI NOER RAHMI, KUSWANTO

PDF (<https://smujo.id/biodiv/article/view/5322/4031>)

The ecology, productivity and economic of swiftlet (*Aerodramus fuciphagus*) farming in Kota Bangun, East Kalimantan, Indonesia (<https://smujo.id/biodiv/article/view/5633>)

MURSIDAH, ABUBAKAR M. LAHJIE, MASJAYA, YAYA RAYADIN, YOSEP RUSLIM

PDF (<https://smujo.id/biodiv/article/view/5633/4032>)

Checklist of mangrove snails (Mollusca: Gastropoda) in South Coast of Pamekasan, Madura Island, East Java, Indonesia (<https://smujo.id/biodiv/article/view/5896>)

R. ADHARYAN ISLAMY, VERYL HASAN

PDF (<https://smujo.id/biodiv/article/view/5896/4033>)

Dipteran diversity and succession pattern on carcass of rabbits treated with opium dross: Implication in forensic medicine (<https://smujo.id/biodiv/article/view/5628>)

DAVOOD KESHAVARZ, YAVAR RASSI, KOUROSH AZIZI, SAYENA RAFIZADEH

PDF (<https://smujo.id/biodiv/article/view/5628/4034>)

Benthic foraminifera as ecological indicators in the Tunda Island Waters, Serang District, Banten Province, Indonesia (<https://smujo.id/biodiv/article/view/5881>)

ISNI NURRUHWATI, FACHRI ARDIANSYAH, YUNIARTI, LINTANG PERMATA SARI YULIADI, RUHYAT PARTASASMITA

PDF (<https://smujo.id/biodiv/article/view/5881/4035>)

Evaluation of antibacterial activity and molecular characterization of bacteria from *Holothuria atra* intestine collected from anthropogenic and non-anthropogenic region in Karimunjawa, Indonesia (<https://smujo.id/biodiv/article/view/5652>)

BAMBANG SULARDIONO, NINIEK WIDYORINI, DJOKO SUPRAPTO, DIAH AYUNINGRUM, ARIF RAHMAN

PDF (<https://smujo.id/biodiv/article/view/5652/4036>)

Three-dimensional structure modeling of a protease from lactic acid bacteria *Leuconostoc mesenteroides* K7 using automated protein homology analysis (<https://smujo.id/biodiv/article/view/5840>)

HABIBI HIDAYAT, WINARTO HARYADI, TRI JOKO RAHARJO

PDF (<https://smujo.id/biodiv/article/view/5840/4037>)

Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight (<https://smujo.id/biodiv/article/view/5850>)

EDY RIWIDIHARSO, DARSONO, ENDANG ARIYANI SETYOWATI, HERY PRATIKNYO,
EMING SUDIANA, SLAMET SANTOSO, EDY YANI, IMAM WIDHIONO

PDF (<https://smujo.id/biodiv/article/view/5850/4038>)

Chemical composition diversity of fucoidans isolated from three tropical
brown seaweeds (Phaeophyceae) species
(<https://smujo.id/biodiv/article/view/5361>)

FADILAH NOR LAILI LUTFIA, ALIM ISNANSETYO, RATNA ASMAH SUSIDARTI,
MUHAMMAD NURSID

PDF (<https://smujo.id/biodiv/article/view/5361/4039>)

The influence of physicochemical environment on the distribution and
abundance of mangrove gastropods in Ngurah Rai Forest Park Bali,
Indonesia (<https://smujo.id/biodiv/article/view/5950>)

AJIE IMAMSYAH, I WAYAN ARTHANA, IDA AYU ASTARINI

PDF (<https://smujo.id/biodiv/article/view/5950/4040>)

Comparison on seed germination and seedling growth between
Indonesian local corn cultivars for decide the quality of seed
(<https://smujo.id/biodiv/article/view/5890>)

ALBERT HUSEIN WAWO, VERINA GITA SUMBOGO, PENI LESTARI

PDF (<https://smujo.id/biodiv/article/view/5890/4041>)

The diversity of pteridophytes in Siberut National Park, Mentawai
Islands, West Sumatra, Indonesia
(<https://smujo.id/biodiv/article/view/6208>)

MILDAWATI, SOBIR, SULISTIJORINI, TATIK CHIKMAWATI

PDF (<https://smujo.id/biodiv/article/view/6208/4042>)

Review artile Review: Traditional ecological knowledge of tribal
communities of North East India
(<https://smujo.id/biodiv/article/view/5901>)

H. TYNSONG, M. DKHAR, B.K. TIWARI

PDF (<https://smujo.id/biodiv/article/view/5901/4043>)

Genetic diversity of lactic acid bacteria isolated from Sumbawa horse
milk, Indonesia (<https://smujo.id/biodiv/article/view/6000>)

KUSDIANAWATI, APON Z. MUSTOPA, FATIMAH, BUGI R. BUDIARTO

PDF (<https://smujo.id/biodiv/article/view/6000/4044>)

Isolation, characterization and efficacy of lytic bacteriophages against pathogenic *Escherichia coli* from hospital liquid waste (<https://smujo.id/biodiv/article/view/5732>)

RAHMAD LINGGA, SRI BUDIARTI, IMAN RUSMANA, ARIS TRI WAHYUDI

PDF (<https://smujo.id/biodiv/article/view/5732/4047>)

Short Communication: Molecular characterization and blood hematology profile of dogs infected by *Ehrlichia canis* in Yogyakarta, Indonesia (<https://smujo.id/biodiv/article/view/5954>)

YUSTINUS OSWIN PRIMAJUNI WUHAN, ARIS HARYANTO, IDA TJAHAJATI

PDF (<https://smujo.id/biodiv/article/view/5954/4045>)

Short communication: Diversity of cave-dwelling bats in Cebu Island, Philippines (<https://smujo.id/biodiv/article/view/5838>)

STEVE MICHAEL T. ALCAZAR, IRENEO L. LIT JR, CARMELITA M. REBANCOS, AIMEE LYNN A. BARRION-DUPO, ANNA PAULINE O. DE GUIA, NATHANIEL C. BANTAYAN, JAMES DV. ALVAREZ

PDF (<https://smujo.id/biodiv/article/view/5838/4046>)

Ethnobotanical investigation on medicinal plants used against human ailments in Erkowit and Sinkat areas, Eastern Sudan (<https://smujo.id/biodiv/article/view/5897>)

MANAR ADAM, ABDEL AZIM, AHMED YAGI, SAKINA YAGI

PDF (<https://smujo.id/biodiv/article/view/5897/4049>)

Molecular identification and population genetic study of *Elaeidobius kamerunicus* Faust. (Coleoptera: Curculionidae) from Indonesia, Malaysia and Cameroon based on mitochondrial gene (<https://smujo.id/biodiv/article/view/5145>)

VAN BASTEN TAMBUNAN, ARDHA APRIYANTO, WALTER AJAMBANG, CULBERTSON ENOW ETTA, BANDUNG SAHARI, DAMAYANTI BUCHORI, PURNAMA HIDAYAT

PDF (<https://smujo.id/biodiv/article/view/5145/4050>)

Short Communication: Antibacterial effect of red betel (*Piper crocatum*) extract in combination with vancomycin against *Staphylococcus aureus* (<https://smujo.id/biodiv/article/view/5818>)

YUSTINA SRI HARTINI, LAURENTIUS HARTANTO NUGROHO

PDF (<https://smujo.id/biodiv/article/view/5818/4048>)

Production efficiency of Inpago Unsoed-1 and Situbagendit rice farming in Central Java, Indonesia (<https://smujo.id/biodiv/article/view/5625>)

ALTRI MULYANI, DWIDJONO HADI DARWANTO, SRI WIDODO, MASYHURI

PDF (<https://smujo.id/biodiv/article/view/5625/4053>)

Metagenomic analysis and biodiversity of Lactic Acid Bacteria (LAB) on masin (fermented sauce) from Sumbawa, West Nusa Tenggara, Indonesia (<https://smujo.id/biodiv/article/view/5783>)

BASO MANGUNTINGI, DINAR SUKSMAYU SAPUTRI, APON ZAENAL MUSTOPA, NURLAILI EKAWATI, CHAIRUL ANAM AFGANI, ARLINDA PUSPITA SARI, LITA TRIRATNA, LINDA SUKMARINI, FATIMAH, AMIRIN KUSMIRAN, SAHRI YANTI, SHASMITA IRAWAN, MUHAMMAD DWI PRASETYO, KHADIJAH ALLIYA FIDIEN

PDF (<https://smujo.id/biodiv/article/view/5783/4054>)

Calophyllum inophyllum extract as a natural enhancer for improving physical properties of bioplastics and natural antimicrobial (<https://smujo.id/biodiv/article/view/5893>)

RINI UMIYATI, RIA MILLATI, TEGUH ARIYANTO, CHUSNUL HIDAYAT

PDF (<https://smujo.id/biodiv/article/view/5893/4055>)

Short Communication: Geometric morphometric analysis of leaf venation in four Shorea species for identification using Digital Image Processing (<https://smujo.id/biodiv/article/view/4556>)

ISHAK ARIAWAN, YENI HERDIYENI, ISKANDAR ZULKARNAEN SIREGAR

PDF (<https://smujo.id/biodiv/article/view/4556/4056>)

The diversity of 'kristal' guava (*Psidium guajava*) fruit quality in response to different altitudes and cultural practices (<https://smujo.id/biodiv/article/view/5072>)

NENI MUSYAROFAH, SLAMET SUSANTO, SANDRA ARIFIN AZIZ, KETTY SUKETI, DADANG

PDF (<https://smujo.id/biodiv/article/view/5072/4057>)

Leaf anatomical variation in *Desmos Lour.* and *Dasymaschalon* (Hook. f. & Thomson) Dalla Torre & Harms species (Annonaceae) (<https://smujo.id/biodiv/article/view/5493>)

ISNA AROFATUN NIKMAH, RUGAYAH RUGAYAH, TATIK CHIKMAWATI

PDF (<https://smujo.id/biodiv/article/view/5493/4058>)

Morphometric and DNA Barcoding of endemic Halmaheran walking shark (*Hemiscyllium halmahera*, Allen, 2013) in North Maluku, Indonesia (<https://smujo.id/biodiv/article/view/5869>)

HAWIS MADDUPPA, ARINI S. P. PUTRI, RIDHO Z. WICAKSONO, BEGINER SUBHAN, NEBUCHADNEZZAR AKBAR, FIRDAUT ISMAIL, DONDY ARAFAT, DERTA PRABUNING, L.M. IQBAL MUKSIN, ENDANG S. SRIMARIANA, ABDURRACHMAN BAKSIR, DIETRIECH G. BENGEN

PDF (<https://smujo.id/biodiv/article/view/5869/4059>)

Short communication: Ecological and faunal complexes of insectivorous mammals of the Republic of Mordovia, Russia (<https://smujo.id/biodiv/article/view/5725>)

ALEXEY ANDREYCHEV

PDF (<https://smujo.id/biodiv/article/view/5725/4060>)

The effect of fermented duckweed (*Lemna minor*) in feed on growth and nutritional quality of tilapia (*Oreochromis niloticus*) (<https://smujo.id/biodiv/article/view/5736>)

VIVI ENDAR HERAWATI, PINANDOYO, Y.S. DARMANTO, NURMANITA RISMANINGSIH, SETO WINDARTO, OCKY KARNA RADJASA

PDF (<https://smujo.id/biodiv/article/view/5736/4061>)

Short Communication: Erythrocytes and leukocytes profiles of bottlenose dolphins (*Tursiops aduncus*) at conservation site (<https://smujo.id/biodiv/article/view/5401>)

ARYANI SISMIN SATYANINGTIJAS, AGUSTIN INDRAWATI, RIZKA F. SYARAFINA, TALITA F. MILANI, M. SURYAPUTRA, AINUL KHADIJA SALEEMA, DESRAYNI HANADHITA

PDF (<https://smujo.id/biodiv/article/view/5401/4062>)

The limiting factors of land suitability for sandalwood (*Santalum album*) in Sumba Island, Indonesia (<https://smujo.id/biodiv/article/view/5289>)

HERY KURNIAWAN, DANI PAMUNGKAS

PDF (<https://smujo.id/biodiv/article/view/5289/4064>)

Farmers' willingness to pay for Sinar donkey conservation in selected districts of Metekel and Assosa zones, northwest Ethiopia: a contingent valuation study (<https://smujo.id/biodiv/article/view/5355>)

AWOKE MELAK, TEKLEWELD BELAYHUN, ESHO KEFYALEW, ABEBE HAILU, AMINE MUSTEFA, ABRAHAM ASSEFA

PDF (<https://smujo.id/biodiv/article/view/5355/4065>)

Antimicrobial activity of ethyl acetate extracts of *Streptomyces* sp. CRB46 and the prediction of their bioactive compounds chemical structure (<https://smujo.id/biodiv/article/view/5687>)

AMBARWATI AMBARWATI, SUBAGUS WAHYUONO, SUKARTI MOELJOPAWIRO, TRIWIBOWO YUWONO

PDF (<https://smujo.id/biodiv/article/view/5687/4066>)

Isolation, identification and antimicrobial activities of Lactic Acid Bacteria from fruits of wild plants in Tambrau Forest, West Papua, Indonesia (<https://smujo.id/biodiv/article/view/5822>)

ACHMAD DINOTO, A'LIYATUR ROSYIDAH, ANGGI RIA PUSPITA SARI SUSILO, HEDDY JULISTIONO

PDF (<https://smujo.id/biodiv/article/view/5822/4067>)

Nest characteristics and populations of Tapanuli Orangutans in the conflict areas, Batangtoru Landscape, North Sumatra, Indonesia (<https://smujo.id/biodiv/article/view/5829>)

WANDA KUSWANDA, R. HAMDANI HARAHAP, HADI S. ALIKODRA, ROBERT SIBARANI

PDF (<https://smujo.id/biodiv/article/view/5829/4068>)

Genetic diversity of *Sterculia quadrifida* in Kupang, Indonesia based on RAPD (Random Amplified Polymorphic DNA) markers (<https://smujo.id/biodiv/article/view/6242>)

USLAN, MADE PHARMAWATI

PDF (<https://smujo.id/biodiv/article/view/6242/4069>)

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>)

Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight

EDY RIWIDIHARSO[✉], DARSONO, ENDANG ARIYANI SETYOWATI, HERY PRATIKNYO, EMING SUDIANA, SLAMET SANTOSO, EDY YANI, IMAM WIDHIONO

Faculty of Biology, Universitas Jenderal Soedirman. Jl. Dr. Soeparno No. 63, Karangwangkal, Purwokerto Utara, Banyumas 53122, Central Java, Indonesia. Tel./fax.: +62-281-638794, ✉email: edyriwi@yahoo.co.id

Manuscript received: 19 April 2020. Revision accepted: 18 June 2020.

Abstract. Riwidiharso E, Darsono, Setyowati EA, Pratiknyo H, Sudiana E, Santoso S, Yani E, Widhiono I. 2020. Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight. *Biodiversitas* 21: 3163-3169. Domestic chickens (*Gallus domesticus*) which are traditionally fed by scavenging on farms predispose them to ectoparasites infestation. In this study, a preliminary survey was conducted on the common ectoparasites on *G. domesticus* in the rural areas of Banyumas District, Central Java, Indonesia. The purpose of this study was to determine the diversity of ectoparasites, their prevalence, and their relationship to the chickens' body weight. This research was conducted by the survey method from December 2019 to April 2020 in five villages around the city of Purwokerto, Banyumas District viz., Kedungwuluh, Kedungwringin, Kutasari, Karangsalam, and Karanggintung. Analysis of ectoparasites diversity was conducted by using the Shannon-Wiener index (H') and Evenness index (E). Analysis of variance was used to calculate the difference in prevalence among sample locations. Regression correlation analysis was used to determine the relationship between prevalence and chicken body weight. The results showed that there were six ectoparasite species i.e., *Dermanyssus gallinae*, *Megninia ginglymura*, *Menacanthus cornutus*, *Menopon gallinae*, *Lipeurus caponis*, and *Haemaphysalis* sp. parasitizing *G. domesticus* in five villages. The number of ectoparasite individuals among locations was significantly different ($F_{5,59} < 32.45$; $p < 0.05$). The highest number of ectoparasite was found in Karangsalam (272 individuals), while the highest prevalence of ectoparasite was *Me. cornutus* (45%). Ectoparasite prevalence was associated with chicken weight loss ($r = 0.98$). The prevalence of ectoparasite of domestic chickens farm in the Banyumas Regency is classified as low but has the potential to influence body weight.

Keywords: Ayam kampung, body weight, ectoparasite, prevalence, traditional farm

INTRODUCTION

Rural chicken farms are generally managed very simply. Consequently, they are very vulnerable to both endo and ectoparasites attack (Suhaila et al. 2015). Domestic chicken production in rural areas faces many obstacles such as insufficient feed, poor management, and poor biosecurity (Nik-Hasan et al. 2015). The habit of releasing native chickens throughout the day to get food on their own makes them very susceptible to ectoparasite attacks. This is because these chickens accidentally contract infective eggs, larvae, and intermediate hosts from ectoparasites. According to Rahman and Haziqoh (2015), ectoparasite attack is one of the main problems in the farming of indigenous chickens in the countryside.

The common ectoparasites in native chickens are fleas and mites. The fleas are generally from the order Phthiraptera, sub order Mallophaga (Suaila et al. 2015). Ilyes et al. (2013) found that ectoparasite attacks can cause health problems in chickens by damaging tissue and causing blood loss and toxicosis dermatitis. In addition to these symptoms, Aleya and Sabrina (2011) also found allergies. Several types of ectoparasites can also cause or act as a vector of various pathogens, which, in severe attacks, will weaken the hens and cause death (Swai et al. 2010; Nik-Hasan et al. 2015). According to Gunya et al. (2020), the most common external parasite in the

scavenging chicken were mites, followed by lice. Lice and mites can cause chick mortality, attributed to starvation and immune suppression from the infestation (Nnadi and George 2010).

Ectoparasites are very common in native chickens in traditional chicken farms in various countries such as USA (California state) (Murillo and Mullens 2016), India (Sreedevi et al. 2016), Bulgaria (Prelezov and Koinarski 2006), Egypt (El-Aw et al. 2008), and Benin (Love et al. 2017). Nik-Hasan et al. (2015) found ectoparasites and their prevalence in Sandakan, Malaysian Borneo to be: *Dermanyssus gallinae* (78%), *Lipeurus caponis* (80%) and *Menopon gallinae* (100%). Love et al. (2017), in their research on chewing lice in selected poultry in Benin, recorded the highest prevalence of ectoparasite was *Menacanthus stramineus* (56%), followed by *Menopon gallinae* (34%) and *Lipeurus caponis* (10%).

Ectoparasites in chickens, aside from the insect class, are also found from the mite class Arachnida and subclass Acari and ticks (Ixodidae). Two species of mites commonly found in chickens around the world are *D. gallinae* and *Megninia ginglymura*. *D. gallinae* is a blood-sucking mite that causes decreased egg-laying ability and anemia in chickens and can be a vector of disease in humans and other animals (Sparagano et al. 2009). The presence of these mites will affect the hens' ability to lay eggs and can cause disease from viruses and bacteria (Marangi et al.

2009). *M. ginglymura* is almost found in chickens and associates with feathers. Its saliva can cause lesions, allergic reactions with pruritus, serous scabs, stress, and itching, leading to the development of petechial hemorrhage, crust formation, secondary bacterial infections, and pyoderma (Faleireo et al. 2015). Huge mortality, slow growth rate, and malnutrition are common problems in scavenging chicken (FAO 2014). Parasitic infection is one of the non-infectious health hazards in backyard chicken, whose severity and diversity are primarily influenced by geography and climatic interaction. The parasitic problem has been identified as one of the causes of low productivity in free-range chicken (Olivirea et al. 2017).

In Banyumas District, chicken farms are maintained traditionally and only at the household scale, with a relatively small chicken population reared in a small scale system. However, this activity is very important for the rural economy and is used as a medium-term saving. Although ectoparasites in native chickens are an important factor in poultry, research on the diversity and prevalence of ectoparasites and their effects on native chicken body weight is still very rare in Indonesia. Therefore, the purpose of this study was to determine the diversity and prevalence of ectoparasites, their attack rates, and their relationship to the bodyweight of the native chicken. The long-term goal of this research is to establish a basis for controlling ectoparasite attacks in left-over native chickens.

MATERIALS AND METHODS

Study area

The study was conducted on 100 scavenging chickens randomly obtained from five villages around Purwokerto, Banyumas District, Central Java, Indonesia, viz., Kedungwuluh (sub-district West Purwokerto), Kedungwringin (sub-district Patikraja), Kutasari (sub-district Baturaden), Karangsalam (sub-district Kedungbanteng) and Karanggintung (sub-district Sumbang) (Figure 1). The chickens had been left scavenging around the house.

Procedures

Chicken sampling procedures

Chicken samples were randomly obtained directly from the owner in the selected village. They were completely left day and night. The average age of the chicken is eight months based on information from the owner. From each village, twenty chickens were taken, consisting of ten hens and ten cocks. Each chicken was weighed. At the time of chicken sampling, environmental conditions of each location were observed, which included the cleanliness of the chicken's living area, chicken population per family, maintenance methods, feeding, and the size of the scavenging area (Table 1).

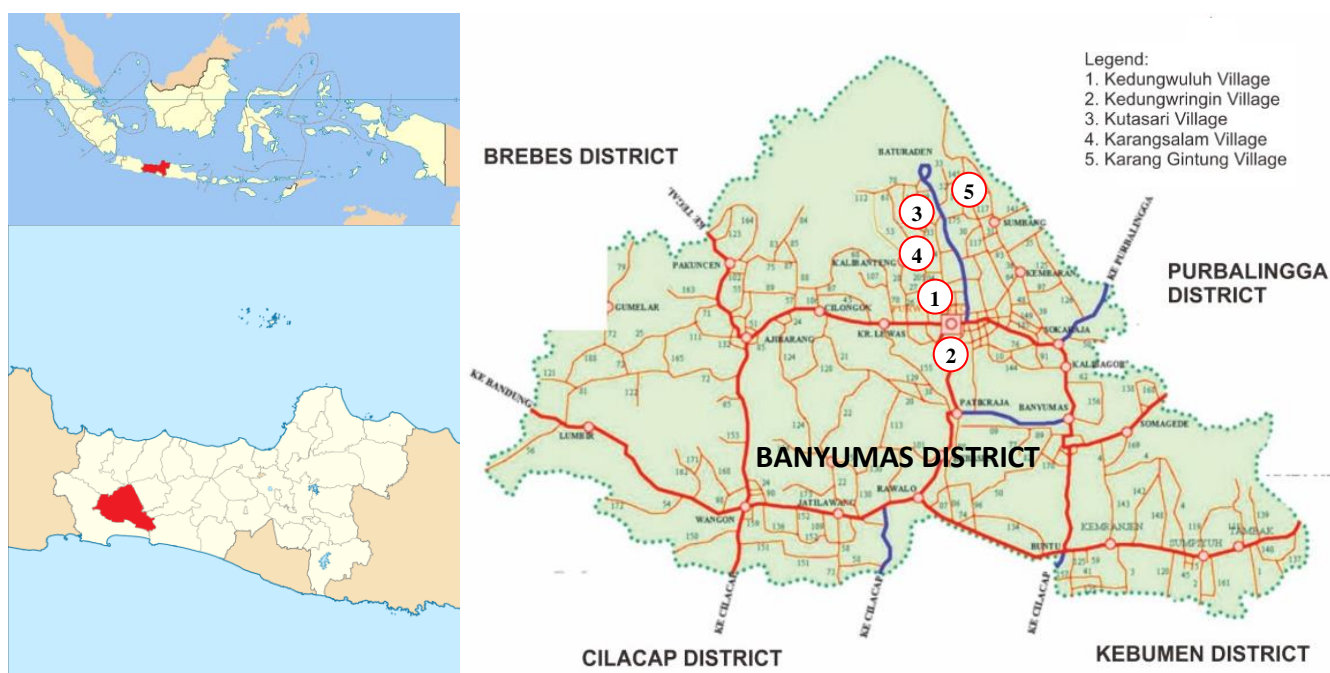


Figure 1. Sampling location at Banyumas District, Central Java, Indonesia

Table 1. Environmental parameters of five domestic chicken sampling sites

Parameter	Kedungwuluh	Kedungwringin	Kutasari	Karangsalam	Karanggintung
Temperature (°C)	30-32	30-32	30-32	30-32	30-32
Humidity (%)	90-95	90-95	90-95	90-95	90-95
Cleanliness	Clean	Clean	Clean	Clean	Dirty
Populations (individual)/ family	10-15	5-10	10-15	10-15	15-20
Living area (m)	<50	<50	<50	<50	>50
Maintenance methods	free	cage	cage	cage	cage

Ectoparasite sampling procedure

Isolation of ectoparasites in the chickens was carried out by examining the following body parts; head-neck, back, wings, chest-legs, and tail. Further, the collected ectoparasites were put into a sample bottle containing 70% ethanol for observation in the Entomology and Parasitology Laboratory, Faculty of Biology, Jenderal Soedirman University. Ectoparasites were separated based on groups namely insects, mites, and ticks under a binocular microscope Olympus CH 20. For identification purposes, the specimens were prepared on an object glass and placed in Hoyer’s solution for clearing in one week, and then they were identified according to Murillo and Mullens (2016).

Data analysis

Analysis of ectoparasites diversity data was done using the Shannon-Wiener index (H') and Evenness index (E). All data were analyzed using BD Pro software (McAleece et al. 1997). Shannon-Wiener diversity and Evenness indexes were calculated with the formula (Magurran 2000):

$$H' = \sum_{i=1}^s pi \ln pi$$

Where; H': Shannon-Wiener diversity index, pi: total individual(s) found within species i.

$$E = \frac{H'}{\ln S}$$

Where; E: Evenness index, H': Shannon-Wiener diversity index, S: total species of ectoparasite.

Simpson’s dominance index was used to measure dominance following this formula:

$$D = \sum (pi)^2 = \sum \left(\frac{ni}{N}\right)^2$$

Where; D: Simpson’s dominance index, ni: total individuals within a species, N: total individuals within all species.

Analysis of variance (ANOVA) was used to calculate the difference in prevalence between sample locations, and between males and females. Regression correlation analysis was used to determine the relationship between prevalence and chicken body weight. All analysis was run with the help of SPSS 21 software.

RESULTS AND DISCUSSION

Ectoparasite diversity

A total of 1047 ectoparasites consisting of three species of lice, two species of mite, and one species of ticks were found in this study. The species of lice encountered were *Menopon gallinae* (Phthiraptera, Menoponidae), *Menacanthus stramineus* (Phthiraptera, Menoponidae), and *Lipeurus caponis* (Phthiraptera, Philopteridae). The mites consisted of *Megninia ginglymura* (Astigmata, Analgidae) and *Dermanyssus gallinae* (Astigmata, Dermanyssidae) and the ticks were *Haemaphysalis* sp. (Ixodida: Ixodidae) (Table 2, Figure 1).

The number of species found is relatively small compared with other studies, probably due to the number of sampling size. High ectoparasite attacks are caused by the level of yard hygiene, air humidity, ambient temperature, and rainfall (Rahman and Haziqoh 2015). This result is in accordance with Nik-Hasan et al. (2015) in their study of parasitic burden and its relation with the bodyweight of free-range chicken in oil palm dominated Sandakan District of Malaysian Borneo where also only four species of ectoparasite were found.

Rahman and Haziqoh (2015) found ten species of ectoparasite in their study on native chicken in urban areas. Furthermore, a high diversity of ectoparasites was found in native chickens in the African region with recorded species including *Menopon gallinae*, *Menacanthus stramineus*, *Menacanthus cornutus*, *Menacanthus pallidulus*, *Lipeurus caponis*, *Goniocotes gallinae*, *Goniodes dissimilis*, *Goniodes gigas* (El-Aw et al. 2013). Zeryehun and Yohannes (2015) recorded five species of mites in the chickens reared under traditional backyard production system in southern Ethiopia.

Table 2. Abundance of ectoparasite in kampung chicken

Species	Location										Σ
	I		II		III		IV		V		
	Cock	Hen	Cock	Hen	Cock	Hen	Cock	Hen	Cock	Hen	
Lice											
<i>Menopon gallinae</i>	31	57	28	20	24	21	34	46	24	25	310
<i>Lipeurus caponis</i>	16	27	18	13	14	16	21	25	11	23	184
<i>Menacanthus cornutus</i>	24	37	34	22	19	28	32	37	21	36	290
Tick											
<i>Haemaphysallis</i> sp.	16	2	17	9	7	3	14	16	18	9	111
Mite											
<i>Dermanyssus gallinae</i>	10	15	12	7	5	1	10	13	7	11	91
<i>Megninia ginglymura</i>	5	5	11	11	5	6	8	16	9	12	88
Total	102	143	120	82	74	75	119	153	90	116	1074

Note: I: Kedungwuluh, II: Kedungwringin, III: Kutasari, IV: Karangsalam, V: Karanggintung

Among all the sampling sites in this study, the most abundant ectoparasite was *Men. gallinae* (310 individuals, 29.60%), followed by *Me. cornutus* (290 individuals, 27%), while the least was *M. ginglymura* with 88 individuals (8%) (Table 1). This result showed that there were no significant differences among the sampling sites ($F_{4,24}$; $p > 0.05$). The dominance of shaft louse (*Men. gallinae*) is very common because this ectoparasite is widespread. *M. gallinae* attacks the base of the feathers and cause loss of chicken feathers. The adults of *Men. gallinae* measure about 2 mm in length, and females deposit eggs singly at the base of the shaft on thigh and breast feathers. Poultry lice typically transfer to new chicken by direct host contact. The abundance number of *Men. gallinae* cause it disperses easily among chicken.

Shannon diversity index (H') among the sampling sites was almost the same, ranging from H' : 1.551 (site III) to H' : 1.712 (site II). This means that all chicken sampled were invested by the same number species of ectoparasite (six ectoparasites) (Table 2). The density of the cage greatly influences the number of ectoparasites in chickens due to the high level of contact between individual chickens, as most transmissions of ectoparasites between individuals are by direct contact (Suahila et al. 2015). Besides insects, this study also found two species of mites, i.e., *D. gallinae* (91 individuals, 8.4%) and *M. ginglymura* (88 individuals, 8.1%). The presence of these mites is common, because they are widespread in chickens throughout the world. *D. gallinae* is hematophagous and responsible for egg downgrading and anemia in birds (Sparagano et al. 2009). This ectoparasite is the most important affecting laying hens worldwide. The presence of this mite has been associated with a viral zoonosis and several bacterial infections (Marangi et al. 2009). One species of ticks

(Acari, Ixodidae) found in this study was *Haemaphysallis* sp., which is a bloodsucking tick and is widely distributed in Southeast Asia. This is a very important parasite in chicken farms because it can cause infection and become a vector of other diseases (Ernieenor et al. 2017). *Haemaphysallis* sp. was also found in the study of Rahman and Haziqoh (2015) in Malaysia with a low population.

The results showed that ectoparasite was found in the four parts observed, namely head-neck, back, wings, chest-legs, and tail. However, ectoparasite species have preferences for different chicken body parts. *L. caponis* was found in all of the observed chicken body parts, *M. cornutus* was found in four parts of the chicken body except wings, *Men. gallinae* was found only in the head-neck, back, and chest-legs. *M. ginglymura* was found only on the wings and tail (Table 4).

Among the body parts of chickens, it was observed that the back and chest-legs were the most common abodes for ectoparasites with five species present, followed by head-neck section with four species, and the wing had with three species. The lice identified were *Men. gallinae*, *Me. cornutus*, *L. caponis*, the mites were *Goniocotes gallinae*, *M. ginglymura*, and the scab was *Haemaphysallis* sp.

Prevalence

At the five sampling locations, the highest prevalence was of *Men. gallinae* (45%), followed by *L. caponis* (40%), *Me. cornutus* (38%), and *M. ginglymura* mites (25%). This is caused by the nature of *Men. gallinae* (chicken body louse) as a voracious feeder so it can spread very fast. In addition, the development of *Men. gallinae* population is greatly influenced by changes in environmental factors, especially the air temperature (Ilyes et al. 2013).

Table 3. Diversity parameters of five different sampling site

Diversity Parameters	Kedungwuluh	Kedungwringin	Kutasari	Karangaslam	Karanggintung
Taxa_S	6	6	6	6	6
Individuals	245	202	149	272	206
Dominance_D	0.2393	0.1941	0.2428	0.2066	0.1956
Shannon_H	1.575	1.712	1.551	1.675	1.707
Simpson_1-D	0.7607	0.8059	0.7572	0.7934	0.8044
Evenness_e^H/S	0.8048	0.9238	0.7863	0.8895	0.9183
Equitability_J	0.8788	0.9558	0.8658	0.9347	0.9524

Table 4. Distribution of ectoparasite in the body regions of the domestic chicken

Body Regions	Ectoparasite											
	<i>M.gallinae</i>		<i>M. cornutus</i>		<i>L. caponis</i>		<i>D. gallinae</i>		<i>M.ginglymura</i>		<i>Haemaphysallis</i> sp.	
	Σ	%	Σ	%	Σ	Σ	Σ	%	Σ	%	Σ	%
Head-neck	142	37.9	130	34.7	72	19.2	31	8.3	-	-	-	-
Back	137	56.4	67	27.6	16	6.6	10	4.1	-	-	2	0.8
Wing	-	-	-	-	26	39.4	-	-	11	4.5	40	60.6
Breast-foot	31	10.5	65	22.03	54	18.3	50	16.9	-	-	36	12.2
Tail	-	-	28	29.5	16	16.8	-	-	59	20.0	33	34.7

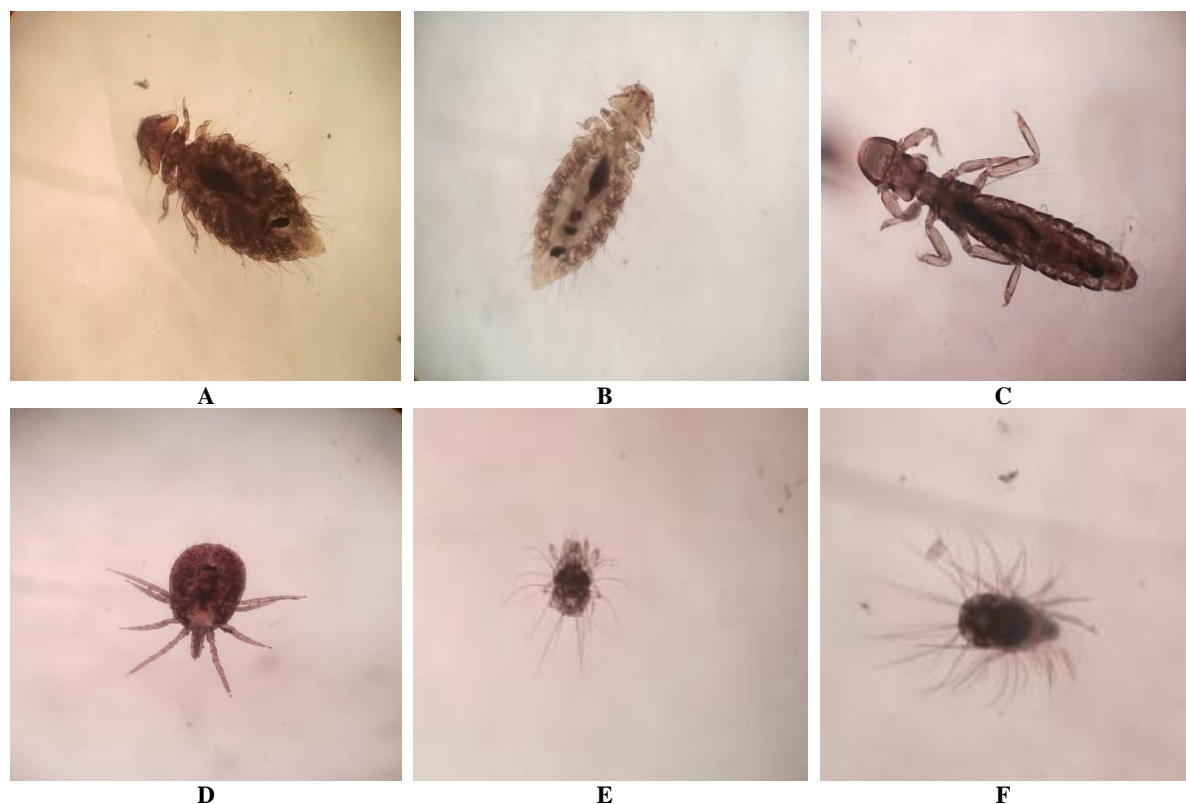


Figure 2. Ectoparasite species found in kampung chickens at five sampling sites. A. *Menopon gallinae*; B. *Menacanthus cornutus*; C. *Lipeurus caponis*; D. *Haemaphysalis* sp.; E. *Dermanyssus gallinae*; F. *Megninia ginglymura*

The results of this study are in line with the majority of studies that found *Men. gallinae* with the highest prevalence. Suhaila et al. (2015) in North Malaysia found four species of ectoparasites, consisting of three lice and a tick, the highest prevalence being of *Men. gallinae* (93.8%), followed by *Me. pallidulus* (81.3%), *Haemaphysalis* sp. (37.5%), and *L. caponis* (18.8%). Furthermore, *Men. gallinae* was also the most common ectoparasite with 76.7% occurrence, followed by *L. caponis* (63.3%) in Penang Malaysia (Rahman and Haziqoh 2015). The same results were found by Ilyes et al. (2013) in their research in Algeria, with the highest prevalence was *Men. gallinae* (97%), followed by *L. caponis* (41%), and *Me. cornutus* only 20%. The dominance of *Men. gallinae* was also recorded by Deephali et al. (2005) in India, Prelezov and Koinarski (2006) in Bulgaria and Marin-Gomez and Benavides-Montano (2007) in Columbia. In Benin, three

species of lice (*Men. gallinae*, *Me. stramineus*, and *L. caponis*) were detected and identified on the local poultry. The most abundant species in the study area is *Men. gallinae*, with a prevalence percentage of about 69.84% (Love et al. 2017), while Mansur et al. (2019) in Egypt found *Men. gallinae* to be the most common ectoparasite with 76.7% occurrence, followed by *L. caponis* (63.3%) and *Me. pallidulus* (41.7%). The difference in this discovery may be due to the difference in environmental factors, especially the daily temperature and humidity (Kaboudi et al. 2019). Overall, the results of this study indicate that the prevalence of ectoparasite in native chicken in Banyumas District is low, compared to the results of research elsewhere. The highest prevalence of *Me. cornutus* only found in the research of Zeryehun and Yohannes (2013) in Ethiopia and Kumar and Kumar (2014) in India.

Table 5. Prevalence of ectoparasite in domestic chicken in five different sampling sites

Species	Location					Prevalence (%) Means ± SD
	Kedungwuluh	Kedungwringin	Kutasari	Karangaslam	Karanggitung	
<i>M. gallinae</i>	40	45	40	45	55	45 ± 5.5
<i>L. caponis</i>	45	40	35	35	45	40 ± 4.5
<i>M. cornutus</i>	35	40	35	35	45	38 ± 4.0
<i>Haemaphysalis</i> sp.	15	20	25	35	35	26 ± 8.0
<i>D. gallinae</i>	25	10	30	25	35	25 ± 8.4
<i>M. synglineura</i>	15	15	30	30	35	25 ± 8.4

Body weight

In this study, there was a real relationship ($r: 0.98$) between ectoparasite attacks and weight loss; the higher the ectoparasites attack, the lower the chicken's body weight. This is probably due to irritation for the chickens, thereby reducing sleep and appetite. Ectoparasites of poultry live on the skin or penetrate into the skin or even in the air sacs, while some live under the feathers. The ectoparasites cause irritation, interfere with feed consumption and are thus associated with emaciation, anemia, and eventual loss of production (Mishra et al. 2017). Although poultry lice are not known to transmit any avian pathogens, the presence of lice frequently accompanies poor health attributable to other causes, and is especially harmful to young birds, where large numbers of lice may cause sleep disruption. *Amblycera* lice may cause irritation to the skin, restlessness, overall weakening, and cessation of feeding. These cause body weight loss, inferior laying capacity, and skin lesions that may become the site for secondary infections (Mullen and Durden 2002). Katoch et al. (2012) reported a 24% loss in the bodyweight of scavenging chicken in India due to parasitism.

Based on the results of the study, the diversity and prevalence of ectoparasite in native chickens in Banyumas District were classified as low. There we only found six species with the highest prevalence of *Men. gallinae* at 45%. Ectoparasite infestations in native chickens can cause chicken weight loss. Therefore, even though the prevalence of ectoparasite is low, this is a key area of consideration by the village chicken farmers to prevent ectoparasite attacks on their chicken, hence boosting productivity.

ACKNOWLEDGEMENTS

We are grateful to Prof. Dr. Suwanto and Prof. Dr. Rifda Naufalin both from University of Jenderal Soedirman Purwokerto, Indonesia, for their support in securing funding for this research, and to all of the students who assisted in collecting field data. This research was supported by funding from the University of Jenderal Soedirman, Purwokerto, Central Java, Indonesia. The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

- Aleya B, Sabrina S. 2011. Prevalence and seasonal variation of ectoparasite in pigeon, *Columba livia* (Gmelin, 1979) of Dhaka, Bangladesh. *Bangladesh J Zool* 39 (2): 223-230.
- El-Aw, MAK, Draz A, Abdel-Hamed A, Awad MA. 2008. Identification of biting lice species on infected domestic chickens and their distribution on different body regions. *J Agric Env Sci Alex Univ Egypt* 7 (2): 137-143.
- Ernieonor FCL, Ernna G, Mariana A. 2017. Phenotypic and genotypic identification of hard ticks of the genus *Haemaphysalis* (Acari: Ixodidae) in Peninsular Malaysia. *Exp Appl Acarol* 71: 387-400.
- Falheiro DCC, Toldi M, Da Silva GL, Ferla NJ. 2015. The ectoparasites *Dermanyssus gallinae* and *Megninia ginglymura*: Bioecology and natural enemies in commercial egg-laying hens. *Syst Appl Acarol* 20 (8): 861-874. DOI: 10.11158/saa.20.8.3
- FAO. 2014. Decision Tools for Family Poultry Development. FAO Animal Production and Health Guidelines, Rome, Italy.
- Gunya B, Muhenje V, Gxasheka M, Tyasi LT, Masika PJ. 2020. Management practices and contribution of village chickens to livelihoods of communal farmers: The case of centane and Mount Frere in Eastern Cape, South Africa. *Biodiversitas* 21 (4): 1345-1351.
- Ilyes M, Ahmed B, Kheira S, Hanena D, Fouz M. 2013. Prevalence and distribution of chewing lice (Phthiraptera) in free-range chickens from the traditional rearing system in the Algerian North East, Area of El-Tarf. *Intl J Poult Sci* 12 (12): 721-725.
- Kaboudi K, Romdhane RB, Salem AB, Bouzouaia M. 2019. Occurrence of ectoparasites in backyard domestic chickens (*Gallus gallus domesticus*) in the northeast of Tunisia. *J Anim Health Prod* 7 (3): 92-98. DOI: 10.17582/journal.jahp/2019/7.3.92.98
- Katoch R, Yadav A, Godara R, Khajuria JK, Borkataki S, Sodhi SS. 2012. Prevalence and impact of gastrointestinal helminths on body weight gain in backyard chickens in subtropical and humid zone of Jammu, India. *J Parasit Dis* 36 (1): 49-52.
- Kumar A, Kumar R. 2014. Seasonal changes in the population of *Menacanthus cornutus* (Phthiraptera: Amblycera). *J Parasit Dis* 38 (3): 307-310.
- Love O, Johnny R, Valentine OR. 2018. A study of the prevalence and abundance of chewing lice (Phthiraptera) in selected poultry farms in Benin City, Edo State. *Intl J Anim Sci Tech* 1 (1): 35-42.
- Mansur KM, Mahmoud NM, Allamoushi SM, El Aziz MM. 2019. Biodiversity and prevalence of chewing lice on local poultry. *J Dairy Vet Anim Res* 8 (1): 26-31.
- Marangi M, Cafiero MA, Capelli G, Camarda A, Sparagano O, Giangaspero A. 2009. Evaluation of the poultry red mite, *Dermanyssus gallinae* (Acari: Dermanyssidae) susceptibility to some acaricides in field populations from Italy. *Exp Appl Acarol* 48: 11-18.
- Magurran EA. 2000. Ecological Diversity and its Measurement. 2nd ed. Chapman and Hall, London.
- Marin-Gomez SY, Benavides-Montano JA. 2007. Parasitos en aves domésticas (*Gallus domesticus*) en el Noroccidente de Colombia. *Vet Zootec* 1: 43-51. [Spanish]
- McAlece N, Lambshhead PJD, Paterson GLJ. 1997. Biodiversity Pro. The Natural History Museum, London.
- Mishra S, Pednekar R, Mohanty BS, Gatne M. 2017. Prevalence, economic loss and control of lice infestation in poultry. *Intl J Sci Environ Tech* 6 (3): 1745-1757.
- Mullen RM, Durden LA. 2002. Medical and Veterinary Entomology. 1st ed. Elsevier Science, Netherlands.
- Murillo AC, Mullens BA. 2016. Diversity and prevalence of ectoparasites on backyard chicken flocks in California. *J Med Entomol* 53 (3): 707-711.
- Nnadi PA, George SO. 2010. A cross-sectional survey on parasites of chickens in selected villages in the subhumid zones of South-Eastern Nigeria. *J Parasitol Res*. DOI: 10.1155/2010/141824.
- Nik-Hassan NRN, Awang A, Rahman AMD. 2015. Parasitic burden and its relation with the bodyweight of free-range chicken in oil palm dominated Sandakan District of Malaysian Borneo. *Intl J Livestock Res*. DOI: 10.5455/ijlr.20150909073638.
- Oliveira TM, Teixeira CM, Arcebispo TCM, Antunes KD, Rezende LC, Cunha LM, Diniz TA, Silva MX. 2017. Epidemiological characterization and risk evaluation associated with the presence of *Megninia* spp. in pasture farms. *Ciência Rural*, Santa Maria, v.47: 09, e20170186.
- Prelezov PN, Koinarski KV. 2006. Species variety and population structure of Mallophaga (Insecta: Phthiraptera) on chickens in the region of Stara Zagora. *Bulgarian J Vet Med* 9 (3): 193-200.
- Rahman WA, Haziqoh F. 2015. Ectoparasitic fauna of scavenging chickens (*Gallus domesticus*) from Penang Island, Peninsular Malaysia. *Malaysian J Vet Res* 6 (1): 33-42
- Sparagano O, Pavlicevic A, Murano T, Camarda A, Sahibi H, Kilpinen O, Mul M, Emous RV, Bouquin S, Hoel K, Cawero MA. 2009. Prevalence and key figures for the poultry red mite *Dermanyssus gallinae* infections in poultry farm systems. *Exp Appl Acarol* 48: 3-10.
- Suhaila AH, Sabrina DL, Ahmad N, Irwan Izzauddin NH, Hamdan A, Khadijah S. 2015. Study of parasites in commercial free-range chickens in northern Peninsular Malaysia. *Malaysian J Vet Res* 6: 53-64

- Sreedevi C, Ramesh P, Mala Kondaiah P, Lakshmi Rani N, & Abhishek M. 2016. Occurrence of *Knemidokoptes mutans* and *Laminosioptes crysticola* in backyard poultry in India. *J Parasitic Dis* 40: 1627-1630.
- Swai ES, Kessy M, Sanka P, Bwanga S, Kaaya JE. 2010. A survey on ectoparasites and haemoparasites of free-range indigenous chickens of Northern Tanzania. *Livest Res Rural Dev* 22 (9).
- Zeryehun T, Yohannes Y. 2015. Ectoparasite infestation of free scavenging chickens reared under traditional backyard production system in Wolayita Zone, Southern Ethiopia. *Ethiopian Vet J* 19 (2): 55-66.

TURNITIN

Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight

by Eming Sudiana

Submission date: 23-Aug-2020 11:08PM (UTC+0700)

Submission ID: 1372911435

File name: BIODIVERSITAS_VOL_21_NO_7_2020__ARTIKEL.pdf (776.79K)

Word count: 4387

Character count: 23445

Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight

EDY RIWIDIHARSO*, DARSONO, ENDANG ARIYANI SETYOWATI, HERY PRATIKNYO,
EMING SUDIANA, SLAMET SANTOSO, EDY YANI, IMAM WIDHIONO

Faculty of Biology, Universitas Jenderal Soedirman, Jl. Dr. Soeparno No. 63, Karangwangkal, Purwokerto Utara, Banyumas 53122, Central Java, Indonesia. Tel./fax.: +62-281-638794, *email: edyriwi@yahoo.co.id

Manuscript received: 19 April 2020. Revision accepted: 18 June 2020.

Abstract. Riwidiharso E, Darsono, Setyowati EA, Pratiknyo H, Sudiana E, Santoso S, Yani E, Widhiono I. 2020. Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight. *Biodiversitas* 21: 3163-3169. Domestic chickens (*Gallus domesticus*) which are traditionally fed by scavenging on farms predispose them to ectoparasites infestation. In this study, a preliminary survey was conducted on the common ectoparasites on *G. domesticus* in the rural areas of Banyumas District, Central Java, Indonesia. The purpose of this study was to determine the diversity of ectoparasites, their prevalence, and their relationship to the chickens' body weight. This research was conducted by the survey method from December 2019 to April 2020 in five villages around the city of Purwokerto, Banyumas District viz., Kedungwuluh, Kedungwringin, Kutasari, Karangsalam, and Karanggintung. Analysis of ectoparasites diversity was conducted by using the Shannon-Wiener index (H') and Evenness index (E). Analysis of variance was used to calculate the difference in prevalence among sample locations. Regression correlation analysis was used to determine the relationship between prevalence and chicken body weight. The results showed that there were six ectoparasite species i.e., *Dermanyssus gallinae*, *Megninia ginglymura*, *Menacanthus cornutus*, *Menopon gallinae*, *Lipeurus caponis*, and *Haemaphysalis* sp. parasitizing *G. domesticus* in five villages. The number of ectoparasite individuals among locations was significantly different ($F_{5,59} < 32.45$; $p < 0.05$). The highest number of ectoparasite was found in Karangsalam (272 individuals), while the highest prevalence of ectoparasite was *Me. cornutus* (45%). Ectoparasite prevalence was associated with chicken weight loss ($r = 0.98$). The prevalence of ectoparasite of domestic chickens farm in the Banyumas Regency is classified as low but has the potential to influence body weight.

Keywords: Ayam kampung, body weight, ectoparasite, prevalence, traditional farm

INTRODUCTION

Rural chicken farms are generally managed very simply. Consequently, they are very vulnerable to both endo and ectoparasites attack (Suhaila et al. 2015). Domestic chicken production in rural areas faces many obstacles such as insufficient feed, poor management, and poor biosecurity (Nik-Hasan et al. 2015). The habit of releasing native chickens throughout the day to get food on their own makes them very susceptible to ectoparasite attacks. This is because these chickens accidentally contract infective eggs, larvae, and intermediate hosts from ectoparasites. According to Rahman and Haziqoh (2015), ectoparasite attack is one of the main problems in the farming of indigenous chickens in the countryside.

The common ectoparasites in native chickens are fleas and mites. The fleas are generally from the order Phthiraptera, sub order Mallophaga (Suaila et al. 2015). Ilyes et al. (2013) found that ectoparasite attacks can cause health problems in chickens by damaging tissue and causing blood loss and toxicosis dermatitis. In addition to these symptoms, Aleya and Sabrina (2011) also found allergies. Several types of ectoparasites can also cause or act as a vector of various pathogens, which, in severe attacks, will weaken the hens and cause death (Swai et al. 2010; Nik-Hasan et al. 2015). According to Gunya et al. (2020), the most common external parasite in the

scavenging chicken were mites, followed by lice. Lice and mites can cause chick mortality, attributed to starvation and immune suppression from the infestation (Nnadi and George 2010).

Ectoparasites are very common in native chickens in traditional chicken farms in various countries such as USA (California state) (Murillo and Millens 2016), India (Sreedevi et al. 2016), Bulgaria (Prelezov and Koinarski 2006), Egypt (El-Aw et al. 2008), and Benin (Love et al. 2017). Nik-Hasan et al. (2015) found ectoparasites and their prevalence in Sandakan, Malaysian Borneo to be: *Dermanyssus gallinae* (78%), *Lipeurus caponis* (80%) and *Menopon gallinae* (100%). Love et al. (2017), in their research on chewing lice in selected poultry in Benin, recorded the highest prevalence of ectoparasite was *Menacanthus stramineus* (56%), followed by *Menopon gallinae* (34%) and *Lipeurus caponis* (10%).

Ectoparasites in chickens, aside from the insect class, are also found from the mite class Arachnida and subclass Acari and ticks (Ixodidae). Two species of mites commonly found in chickens around the world are *D. gallinae* and *Megninia ginglymura*. *D. gallinae* is a blood-sucking mite that causes decreased egg-laying ability and anemia in chickens and can be a vector of disease in humans and other animals (Sparagano et al. 2009). The presence of these mites will affect the hens' ability to lay eggs and can cause disease from viruses and bacteria (Marangi et al.

2009). *M. ginglymura* is almost found in chickens and associates with feathers. Its saliva can cause lesions, allergic reactions with pruritus, serous scabs, stress, and itching, leading to the development of petechial hemorrhage, crust formation, secondary bacterial infections, and pyoderma (Faleireo et al. 2015). Huge mortality, slow growth rate, and malnutrition are common problems in scavenging chicken (FAO 2014). Parasitic infection is one of the non-infectious health hazards in backyard chicken, whose severity and diversity are primarily influenced by geography and climatic interaction. The parasitic problem has been identified as one of the causes of low productivity in free-range chicken (Oliviera et al. 2017).

In Banyumas District, chicken farms are maintained traditionally and only at the household scale, with a relatively small chicken population reared in a small scale system. However, this activity is very important for the rural economy and is used as a medium-term saving. Although ectoparasites in native chickens are an important factor in poultry, research on the diversity and prevalence of ectoparasites and their effects on native chicken body weight is still very rare in Indonesia. Therefore, the purpose of this study was to determine the diversity and prevalence of ectoparasites, their attack rates, and their relationship to the bodyweight of the native chicken. The long-term goal of this research is to establish a basis for controlling ectoparasite attacks in left-over native chickens.

Study area

The study was conducted on 100 scavenging chickens randomly obtained from five villages around Purwokerto, Banyumas District, Central Java, Indonesia, viz., Kedungwuluh (sub-district West Purwokerto), Kedungwringin (sub-district Patikraja), Kutasari (sub-district Baturaden), Karangaslam (sub-district Kedungbanteng) and Karanggintung (sub-district Sumbang) (Figure 1). The chickens had been left scavenging around the house.

Procedures

Chicken sampling procedures

Chicken samples were randomly obtained directly from the owner in the selected village. They were completely left day and night. The average age of the chicken is eight months based on information from the owner. From each village, twenty chickens were taken, consisting of ten hens and ten cocks. Each chicken was weighed. At the time of chicken sampling, environmental conditions of each location were observed, which included the cleanliness of the chicken's living area, chicken population per family, maintenance methods, feeding, and the size of the scavenging area (Table 1).

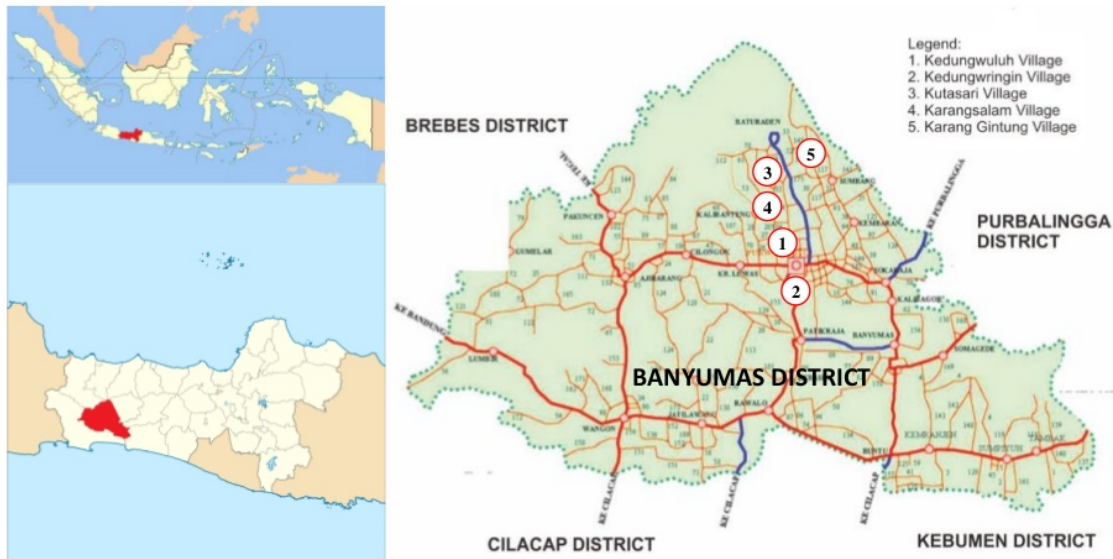


Figure 1. Sampling location at Banyumas District, Central Java, Indonesia

Table 1. Environmental parameters of five domestic chicken sampling sites

Parameter	Kedungwuluh	Kedungwringin	Kutasari	Karangaslam	Karanggintung
Temperature (°C)	30-32	30-32	30-32	30-32	30-32
Humidity (%)	90-95	90-95	90-95	90-95	90-95
Cleanliness	Clean	Clean	Clean	Clean	Dirty
Populations (individual)/ family	10-15	5-10	10-15	10-15	15-20
Living area (m)	<50	<50	<50	<50	>50
Maintenance methods	free	cage	cage	cage	cage

Ectoparasite sampling procedure

Isolation of ectoparasites in the chickens was carried out by examining the following body parts; head-neck, back, wings, chest-legs, and tail. Further, the collected ectoparasites were put into a 5 ml bottle containing 70% ethanol for observation in the Entomology and Parasitology Laboratory, Faculty of Biology, Jenderal Soedirman University. Ectoparasites were separated based on groups namely insects, mites, and ticks under a binocular microscope Olympus CH 20. For identification purposes, the specimens were prepared on an object glass and placed in Hoyer’s solution for clearing in one week, and then they were identified according to Murillo and Mullens (2016).

Data analysis

Analysis of ectoparasites diversity data was done using the Shannon-Wiener index (H') and Evenness index (E). All data were analyzed using BD Pro software (McAleece et al. 1997). Shannon-Wiener diversity and Evenness indexes were calculated with the formula (Magurran 2000):

$$H' = \sum_{i=1}^s pi \ln pi$$

Where; H': Shannon-Wiener diversity index, pi: total individual(s) found within species i.

$$E = \frac{H'}{\ln S}$$

Where; E: Evenness index, H': Shannon-Wiener diversity index, S: total species of ectoparasite.

Simpson’s dominance index was used to measure dominance following this formula:

$$D = \sum (pi)^2 = \sum (\frac{ni}{N})^2$$

Where; D: Simpson’s dominance index, ni: total individuals within a species, N: total individuals within all species.

36

Analysis of variance (ANOVA) was used to calculate the difference in prevalence between sample locations, and between males and females. Regression correlation analysis was used to determine the relationship between prevalence and chicken body weight. All analysis was run with the help of SPSS 21 software.

RESULTS AND DISCUSSION

Ectoparasite diversity

A total of 1047 ectoparasites consisting of three species of lice, two species of mite, and one species of ticks were found in this study. The species of lice encountered were *Menopon gallinae* (Phthiraptera, Menoponidae), *Menacanthus stramineus* (Phthiraptera, Menoponidae), and *Lipeurus caponis* (Phthiraptera, Philopteridae). The mites consisted of *Megninia ginglymura* (Astigmata, Analgidae) and *Dermanyssus gallinae* (Astigmata, Dermanyssidae) and the ticks were *Haemaphysalis* sp. (Ixodida: Ixodidae) (Table 2, Figure 1).

The number of species found is relatively small compared with other studies, probably due to the number of sampling size. High ectoparasite attacks are caused by the level of yard hygiene, air humidity, ambient temperature, and rainfall (Rahman and Haziqoh 2015). This result is in accordance with Nik-Hasan et al. (2015) in their study of parasitic burden and its relation with the bodyweight of free-range chicken in oil palm dominated Sandakan District of Malaysian Borneo where also only four species of ectoparasite were found.

Rahman and Haziqoh (2015) found ten species of ectoparasite in their study on native chicken in urban areas. Furthermore, a high diversity of ectoparasites was found in native chickens in the African region with recorded species including *Menopon gallinae*, *Menacanthus stramineus*, *Menacanthus cornutus*, *Menacanthus pallidulus*, *Lipeurus caponis*, *Goniocotes gallinae*, *Goniodes dissimilis*, *Goniodes gigas* (El-Aw et al. 2013). Zeryehun and Phannes (2015) recorded five species of mites in the chickens reared under traditional backyard production system in southern Ethiopia.

Table 2. Abundance of ectoparasite in kampung chicken

Species	Location										Σ
	I		II		III		IV		V		
	Cock	Hen	Cock	Hen	Cock	Hen	Cock	Hen	Cock	Hen	
Lice											
<i>Menopon gallinae</i>	31	57	28	20	24	21	34	46	24	25	310
<i>Lipeurus caponis</i>	16	27	18	13	14	16	21	25	11	23	184
<i>Menacanthus cornutus</i>	24	37	34	22	19	28	32	37	21	36	290
Tick											
<i>Haemaphysallis</i> sp.	16	2	17	9	7	3	14	16	18	9	111
Mite											
<i>Dermanyssus gallinae</i>	10	15	12	7	5	1	10	13	7	11	91
<i>Megninia ginglymura</i>	5	5	11	11	5	6	8	16	9	12	88
Total	102	143	120	82	74	75	119	153	90	116	1074

Note: I: Kedungwuluh, II: Kedungwringin, III: Kutasari, IV: Karangsalam, V: Karangintung

Among all the sampling sites in this study, the most abundant ectoparasite was *Men. gallinae* (310 individuals, 29.60%), followed by *Me. cornuthus* (290 individuals, 27%), while the least was *M. ginglymura* with 88 individuals (8%) (Table 1). This result showed that there were no significant differences among the sampling sites ($F_{4,24}$; $p > 0.05$). The dominance of shaft louse (*Men. gallinae*) is very common because this ectoparasite is widespread. *M. gallinae* attacks the base of the feather and cause loss of chicken feathers. The adults of *Men. gallinae* measure about 2 mm in length, and females deposit eggs singly at the base of the shaft on thigh and breast feathers. Poultry lice typically transfer to new chicken by direct host contact. The abundance number of *Men. gallinae* cause it disperses easily among chicken.

Shannon diversity index (H') among the sampling sites was almost the same, ranging from H': 1.551 (site III) to H': 1.712 (site II). This means that all chicken sampled were invested by the same number species of ectoparasite (six ectoparasites) (Table 2). The density of the cage greatly influences the number of ectoparasites in chickens due to the high level of contact between individual chickens, as most transmissions of ectoparasites between individuals are by direct contact (Suahila et al. 2015). Besides insects, this study also found two species of mites, i.e., *D. gallinae* (91 individuals, 8.4%) and *M. ginglymura* (88 individuals, 8.1%). The presence of these mites is common, because they are widespread in chickens throughout the world. *D. gallinae* is hematophagous and responsible for egg downgrading and anemia in birds (Sparagano et al. 2009). This ectoparasite is the most important affecting laying hens worldwide. The presence of this mite has been associated with a viral zoonosis and several bacterial infections (Marangi et al. 2009). One species of ticks

(Acari, Ixodidae) found in this study was *Haemaphysallis* sp., which is a bloodsucking tick and is widely distributed in Southeast Asia. This is a very important parasite in chicken farms because it can cause infection and become a vector of other diseases (Ernieenor et al. 2017). *Haemaphysallis* sp. was also found in the study of Rahman and Haziqoh (2015) in Malaysia with a low population.

The results showed that ectoparasite was found in the four parts observed, namely head-neck, back, wings, chest-legs, and tail. However, ectoparasite species have preferences for different chicken body parts. *L. caponis* was found in all of the observed chicken body parts, *M. cornutus* was found in four parts of the chicken body except wings, *Men. gallinae* was found only in the head-neck, back, and chest-legs. *M. ginglymura* was found only on the wings and tail (Table 4).

Among the body parts of chickens, it was observed that the back and chest-legs were the most common abodes for ectoparasites with five species present, followed by head-neck section with four species, and the wing had with three species. The lice identified were *Men. gallinae*, *Me. cornutus*, *L. caponis*, the mites were *Goniocotes gallinae*, *M. ginglymura*, and the scab was *Haemaphysallis* sp.

Prevalence

At the five sampling locations, the highest prevalence was of *Men. gallinae* (45%), followed by *L. caponis* (40%), *Me. cornutus* (38%), and *M. ginglymura* mites (25%). This is caused by the nature of *Men. gallinae* (chicken body louse) as a voracious feeder so it can spread very fast. In addition, the development of *Men. gallinae* population is greatly influenced by changes in environmental factors, especially the air temperature (Ilyes et al. 2013).

Table 3. Diversity parameters of five different sampling site

Diversity Parameters	Kedungwuluh	Kedungwringin	Kutasari	Karangaslam	Karanggintung
Taxa_S	6	6	6	6	6
Individuals	245	202	149	272	206
Dominance_D	0.2393	0.1941	0.2428	0.2066	0.1956
Shannon_H	1.575	1.712	1.551	1.675	1.707
Simpson_1-D	0.7607	0.8059	0.7572	0.7934	0.8044
Evenness_e^H/S	0.8048	0.9238	0.7863	0.8895	0.9183
Equitability_J	0.8788	0.9558	0.8658	0.9347	0.9524

Table 4. Distribution of ectoparasite in the body regions of the domestic chicken

Body Regions	Ectoparasite											
	<i>M.gallinae</i>		<i>M. cornutus</i>		<i>L. caponis</i>		<i>D. gallinae</i>		<i>M.ginglymura</i>		<i>Haemaphysallis</i> sp.	
	Σ	%	Σ	%	Σ	Σ	Σ	%	Σ	%	Σ	%
Head-neck	142	37.9	130	34.7	72	19.2	31	8.3	-	-	-	-
Back	137	56.4	67	27.6	16	6.6	10	4.1	-	-	2	0.8
Wing	-	-	-	-	26	39.4	-	-	11	4.5	40	60.6
Breast-foot	31	10.5	65	22.03	54	18.3	50	16.9	-	-	36	12.2
Tail	-	-	28	29.5	16	16.8	-	-	59	20.0	33	34.7

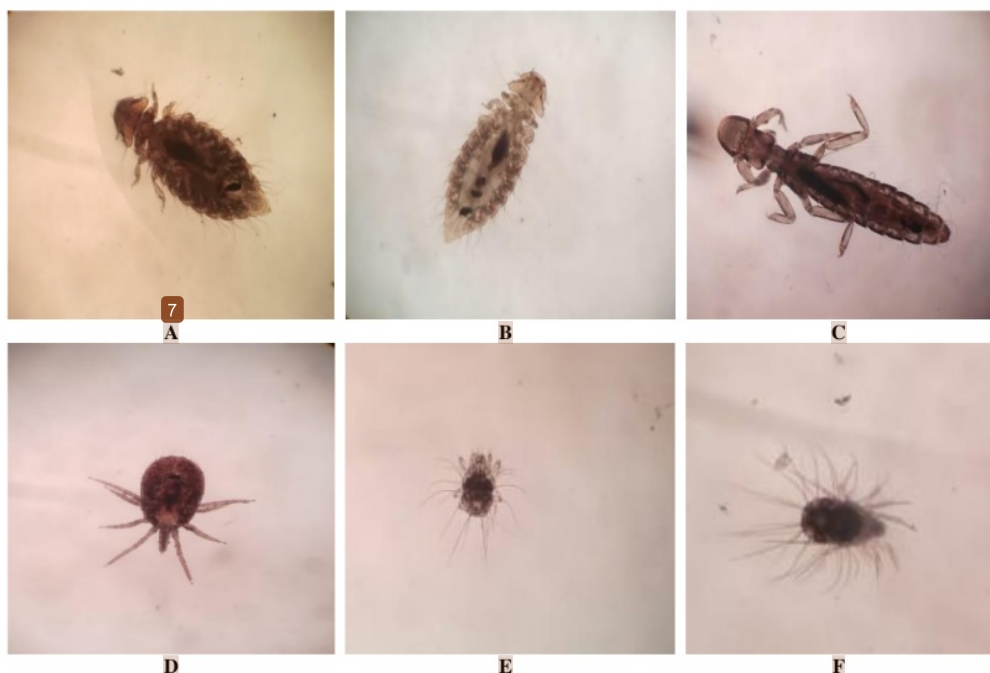


Figure 2. Ectoparasite species found in kampong chickens at five sampling sites. A. *Menopon gallinae*; B. *Menacanthus cornutus*; C. *Lipeurus caponis*; D. *Haemaphysalis* sp.; E. *Dermanyssus gallinae*; F. *Megninia ginglymura*

The results of this study are in line with the majority of studies that found *Men. gallinae* with the highest prevalence. Suhaila et al. (2015) in North Malaysia found four species of ectoparasites, consisting of three lice and a tick, the highest prevalence being of *Men. gallinae* (93.8%), followed by *Me. pallidulus* (81.3%), *Haemaphysalis* sp. (77.5%), and *L. caponis* (18.8%). Furthermore, *Men. gallinae* was also the most common ectoparasite with 76.7% occurrence, followed by *L. caponis* (63.3%) in Penang Malaysia (Rahman and Haziqoh 2015). The same results were found by Ilyes et al. (2013) in their research in Algeria, with the highest prevalence was *Men. gallinae* (97%), followed by *L. caponis* (41%), and *Me. cornutus* only 20%. The dominance of *Men. gallinae* was also recorded by Deephali et al. (2005) in India, Prelezov and Koinarski (2006) in Bulgaria and Marin-Gomez and Benavides-Montano (2007) in Columbia. In Benin, three

species of lice (*Men. gallinae*, *Me. stramineus*, and *L. caponis*) were detected and identified on the local poultry. The most abundant species in the study area is *Men. gallinae*, with a prevalence percentage of about 69.84% (Love et al. 2017), while Insur et al. (2019) in Egypt found *Men. gallinae* to be the most common ectoparasite with 76.7% occurrence, followed by *L. caponis* (63.3%) and *Me. pallidulus* (41.7%). The difference in this discovery may be due to the difference in environmental factors, especially the daily temperature and humidity (Kaboudi et al. 2019). Overall, the results of this study indicate that the prevalence of ectoparasite in native chicken in Banyumas District is low, compared to the results of research elsewhere. The highest prevalence of *Me. cornutus* only found in the research of Zeryehun and Yohannes (2013) in Ethiopia and Kumar and Kumar (2014) in India.

40

Table 5. Prevalence of ectoparasite in domestic chicken in five different sampling sites

Species	Location					Prevalence (%) Means ± SD
	Kedungwuluh	Kedungwringin	Kutasari	Karangaslam	Karanggintung	
<i>M. gallinae</i>	40	45	40	45	55	45 ± 5.5
<i>L. caponis</i>	45	40	35	35	45	40 ± 4.5
<i>M. cornutus</i>	35	40	35	35	45	38 ± 4.0
<i>Haemaphysalis</i> sp.	15	20	25	35	35	26 ± 8.0
<i>D. gallinae</i>	25	10	30	25	35	25 ± 8.4
<i>M. synglineura</i>	15	15	30	30	35	25 ± 8.4

Body weight

In this study, there was a real relationship ($r: 0.98$) between ectoparasite attacks and weight loss; the higher the ectoparasites attack, the lower the chicken's body weight. This is probably due to irritation for the chickens, thereby reducing sleep and appetite. Ectoparasites of poultry live on the skin or penetrate into the skin or even in the air sacs, while some live under the feathers. The ectoparasites cause irritation, interfere with feed consumption and are thus associated with emaciation, anemia, and eventual loss of production (Mishra et al. 2017). Although poultry lice are not known to transmit any avian pathogens, the presence of lice frequently accompanies poor health attributable to other causes, and is especially harmful to young birds, where large numbers of lice may cause sleep disruption. *Amblycera* lice may cause irritation to the skin, restlessness, overall weakening, and cessation of feeding. These cause body weight loss, inferior laying capacity, and skin lesions that may become the site for secondary infections (Mullen and Durden 2002). Katoch et al. (2012) reported a 24% loss in the bodyweight of scavenging chicken in India due to parasitism.

Based on the results of the study, the diversity and prevalence of ectoparasite in native chickens in Banyumas District were classified as low. There we only found six species with the highest prevalence of *Men. gallinae* at 45%. Ectoparasite infestations in native chickens can cause chicken weight loss. Therefore, even though the prevalence of ectoparasite is low, this is a key area of consideration by the village chicken farmers to prevent ectoparasite attacks on their chicken, hence boosting productivity.

ACKNOWLEDGEMENTS

We are grateful to Prof. Dr. Suwanto and Prof. Dr. Rifda Naufalin both from University of Jenderal Soedirman Purwokerto, Indonesia, for their support in securing funding for this research, and to all of the students who assisted in collecting field data. This research was supported by funding from the University of Jember Soedirman, Purwokerto, Central Java, Indonesia. The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

- 14 Aleya B, Sabrina S. 2011. Prevalence and seasonal variation of ectoparasite in pigeon, *Columba livia* (Gmelin, 1799) of Dhaka, Bangladesh. *Bangladesh J Zool* 39 (2): 223-230.
- El-Aw, MAK, Draz A, Abdel-Hamed A, Awad MA. 2008. Identification of biting lice species on infested domestic chickens and their distribution on different body regions. *J Agric Env Sci Alex Univ Egypt* 7 (2): 137-143.
- 12 Ernieonor FCL, Emna G, Mariana A. 2017. Phenotypic and genotypic identification of hard ticks of the genus *Haemaphysalis* (Acari: Ixodidae) in Peninsular Malaysia. *Exp Appl* 15: 387-400.
- Falciro DCC, Toldi M, Da Silva GL, Ferla NJ. 2015. The ectoparasites *Dermanyssus gallinae* and *Megninia ginglymura*: Bioecology and natural enemies in commercial egg-laying hens. *Syst Appl Acarol* 20 (8): 861-874. DOI: 10.11158/saa.20.8.3
- 22 FAO. 2014. Decision Tools for Family Poultry Development. FAO Animal Production and Health Guidelines, Rome, Italy.
- 18 Gurb, Muhenje V, Gxasheka M, Tyasi LT, Masika PJ. 2020. Management practices and contribution of village chickens to livelihoods of communal farmers: The case of centane and Mount Frere in Eastern Cape, South Africa. *Biodiversitas* 21 (4): 1345-1351.
- 8 Ilyes M, Ahmed B, Kheira S, Hanene D, Fouz M. 2013. Prevalence and distribution of chewing lice (Phthiraptera) in free-range chickens from the traditional rearing system in the Algerian North East. *Area of El-Tarf. Intl J Poultry Sci* 12 (12): 721-725.
- Kaboudi K, Romdhane RB, Salem AB, Bouzou M. 2019. Occurrence of ectoparasites in backyard domestic chickens (*Gallus gallus domesticus*) in the northeast of Tunisia. *J Anim Health Prod* 7 (3): 92-98. DOI: 10.17582/journal.jahp/2019/7.3.92.98
- 9 Katoch R, Yadav A, Godara R, Khajuria JK, Borkataki S, Sodhi SS. 2012. Prevalence and impact of gastrointestinal helminths on body weight gain in backyard chickens in subtropical and humid zone of Jammu, India. *J Parasit Dis* 36 (1): 49-52.
- Kumar A, Kumar R. 2014. Seasonal changes in the population of *Menacanthus cornutus* (Phthiraptera: Amblycera). *J Parasit Dis* 38 (3): 307-310.
- Love O, Johnny R, Valentine OR. 2018. A study of the prevalence and abundance of chewing lice (Phthiraptera) in selected poultry farms in Benin City, Edo State. *Intl J Anim Sci Tech* 1 (1): 35-42.
- Mansur KM, Mahmoud NM, Allamoushi SM, El Aziz MM. 2019. Biodiversity and prevalence of chewing lice on local poultry. *J Dairy Vet Anim Res* 8 (1): 26-31.
- 1 Marangi M, Caffero MA, Capelli G, Camarda A, Sparagano O, Giangaspero A. 2009. Evaluation of the poultry red mite, *Dermanyssus gallinae* (Acari: Dermanyssidae) susceptibility to some acaricides in field situations from Italy. *Exp Appl Acarol* 48: 11-18.
- Magurran EA. 2000. *Ecological Diversity and its Measurement*. 2nd ed. Chapman and Hall, London.
- 20 Marin-Gomez SY, Benavides-Montano JA. 2007. Parasitos en aves domésticas (*Gallus domesticus*) en el Noroccidente de Colombia. *Vet Zootec* 1: 43-51. [Spanish]
- 26 McAleece N, Lamshead PJD, Paterson GLJ. 1997. *Biodiversity Pro. The Natural History Museum, London.*
- 3 Mishra S, Pednekar R, Mohanty BS, Gatne M. 2017. Prevalence, economic loss and control of lice infestation in poultry. *Intl J Sci Environ* 37: 6 (3): 1745-1757.
- Mullen RM, Durden LA. 2002. *Medical and Veterinary Entomology*. 1st ed. Elsevier Science, Netherlands.
- 21 Murillo AC, Mullens BA. 2016. Diversity and prevalence of ectoparasites on backyard chicken flocks in California. *J Med Entomol* 53 (3): 707-711.
- 10 Nnadi PA, George SO. 2010. A cross-sectional survey on parasites of chickens in selected villages in the subhumid zones of South-Eastern Nigeria. *J Parasitol Res*. DOI: 10.1155/2010/141824.
- Nik-Hassan NRN, Awang A, Rahman AMD. 2015. Parasitic burden and its relation with the bodyweight of free-range chicken in oil palm dominated Sandakan District of Malaysian Borneo. *Intl J Livestock Res*. DOI: 10.5455/ijlr.20150909073638.
- Oliveira TM, Teixeira CM, Arcebispo TCM, Antunes R, Rezende LC, Cunha LM, Diniz TA, Silva MX. 2017. Epidemiological characterization and risk evaluation associated with the presence of *Megninia* spp. in pasture farms. *Ciência Rural*, Santa Maria, v.47: 09, e20170186.
- 17 Prelezov PN, Koinarski KV. 2006. Species variety and population structure of Mallophaga (Insecta: Phthiraptera) on chickens in the region of Stara Zagora. *Bulgarian J Vet Med* 9 (3): 193-200.
- Rahman WA, Haziqoh F. 2015. Ectoparasitic fauna of scavenging chickens (*Gallus domesticus*) from Penang Island, Peninsular Malaysia. *Malaysian J Vet Res* 6 (1): 33-42
- 1 Sparagano O, Pavlicevic A, Murano T, Camarda A, Sahibi H, Kilpinen O, Mul M, Emous RV, Bouquin S, Hoel K, Cawero MA. 2009. Prevalence and key figures for the poultry red mite *Dermanyssus gallinae* infections in poultry farm systems. *Exp Appl Acarol* 48: 3-10.
- Suhaila AH, Sabrina DL, Ahm, Irwan Izzauddin NH, Hamdan A, Khadijah S. 2015. Study of parasites in commercial free-range chickens in northern Peninsular Malaysia. *Malaysian J Vet Res* 6: 53-64

16

Sreedevi C, Ramesh P, Mala Kondaiah P, Lakshmi Rani N, & Abhishek M. 2016. Occurrence of *Knemidokoptes mutans* and *Laminosioptes crysti* in backyard poultry in India. *J Parasitic Dis* 40: 1627-1630.

Swai ES, Kessy M, Sanka P, Bwanga S, Kaaya JE. 2010. A survey on ectoparasites and haemoparasites of free-range indigenous chickens of Northern Tanzania. *Livest Res Rural Dev* 22 (9).

13

Zeryehun T, Yohannes Y. 2015. Ectoparasite infestation of free scavenging chickens reared under traditional backyard production system in Wolayita Zone, Southern Ethiopia. *Ethiopian Vet J* 19 (2): 55-66.

Prevalence and diversity of ectoparasites in scavenging chickens (*Gallus domesticus*) and their association to body weight

ORIGINALITY REPORT

24%

SIMILARITY INDEX

22%

INTERNET SOURCES

17%

PUBLICATIONS

10%

STUDENT PAPERS

PRIMARY SOURCES

1

edepot.wur.nl

Internet Source

2%

2

www.ajol.info

Internet Source

2%

3

www.ijset.net

Internet Source

2%

4

bioone.org

Internet Source

1%

5

www.neliti.com

Internet Source

1%

6

Submitted to Midlands State University

Student Paper

1%

7

mafiadoc.com

Internet Source

1%

8

directresearchpublisher.org

Internet Source

1%

9

C. Sreedevi, Ch. Jyothisree, V. Rama Devi, P.

Annapurna, L. Jeyabal. "Seasonal prevalence of gastrointestinal parasites in desi fowl (*Gallus gallus domesticus*) in and around Gannavaram, Andhra Pradesh", *Journal of Parasitic Diseases*, 2014

1%

Publication

10

L. Jayentakumar Singh, N. Mohilal. "Gastrointestinal parasitic infection in diverse species of domestic birds of Manipur, India", *Journal of Parasitic Diseases*, 2016

1%

Publication

11

epdf.pub
Internet Source

1%

12

Van Lun Low, Batah Kunalan Prakash. "First genetic characterization of the brown dog tick *Rhipicephalus sanguineus sensu lato* in Peninsular Malaysia", *Experimental and Applied Acarology*, 2018

1%

Publication

13

www.sryahwapublications.com
Internet Source

1%

14

rd.springer.com
Internet Source

1%

15

Tamara Bianca Horn, Juliana Granich, Vinícius Leão da Silva, Noeli Juarez Ferla. "Population fluctuation of predatory and sanitary importance

1%

mites (Acari) in commercial laying hens:
Ecological interactions", Veterinary Parasitology,
2019

Publication

16

www.frontiersin.org

Internet Source

1%

17

V. A. Yevstafieva. "Chewing Lice (Order Mallophaga, Suborders Amblycera and Ichnocera) Fauna of Domestic Chicken (*Gallus Gallus Domesticus*) in Ukraine", Vestnik Zoologii, 2015

Publication

1%

18

www.semanticscholar.org

Internet Source

1%

19

www.veterinaryworld.org

Internet Source

<1%

20

journals.usamvcluj.ro

Internet Source

<1%

21

"Pests and vector-borne diseases in the livestock industry", Wageningen Academic Publishers, 2018

Publication

<1%

22

meas.illinois.edu

Internet Source

<1%

23

www.hindawi.com

Internet Source

<1%

24

pressreleases.scielo.org

Internet Source

<1%

25

docplayer.net

Internet Source

<1%

26

core.ac.uk

Internet Source

<1%

27

eurekamag.com

Internet Source

<1%

28

Submitted to Universiti Teknologi MARA

Student Paper

<1%

29

K.L. Adang, R. Asher, R. Abba. "Gastro-intestinal Helminths of Domestic Chickens Gallus gallus domestica and Ducks Anas platyrhynchos Slaughtered at Gombe Main Market, Gombe State, Nigeria", Asian Journal of Poultry Science, 2014

Publication

<1%

30

repository.ipb.ac.id

Internet Source

<1%

31

worldwidescience.org

Internet Source

<1%

32

www.bioscientistjournal.com

Internet Source

<1%

33

journals.ansfoundation.org

<1%

34

Bhavani E. Narayanaswamy, Brian J. Bett, John D. Gage. "Ecology of bathyal polychaete fauna at an Arctic–Atlantic boundary (Faroe–Shetland Channel, North-east Atlantic)", Marine Biology Research, 2005

Publication

<1%

35

www.conscientiabeam.com

Internet Source

<1%

36

sasas.co.za

Internet Source

<1%

37

M. Jahantigh, R. Esmailzade dizaji, Y. Teymoori. "Prevalence of external parasites of pigeon in Zabol, southeast of Iran", Journal of Parasitic Diseases, 2015

Publication

<1%

38

Farid Rezaei, Mohammad Hashemnia, Abdolali Chalechale, Shahin Seidi, Maryam Gholizadeh. "Prevalence of ectoparasites in free-range backyard chickens, domestic pigeons (*Columba livia domestica*) and turkeys of Kermanshah province, west of Iran", Journal of Parasitic Diseases, 2014

Publication

<1%

39

T. Makwanise, S. Dube, M.S. Sibula. "Molecular

characterization of Raillietina isolates from the gastrointestinal tract of free range chickens (Gallus Gallus domesticus) from the southern region of Zimbabwe using the 18S rDNA gene", Veterinary Parasitology: Regional Studies and Reports, 2020

Publication

<1%

40

Peninah Wamboi, Robert M. Waruiru, Paul G. Mbutia, James M. Nguhiu, Lilly C. Bebora. "Haemato-biochemical changes and prevalence of parasitic infections of indigenous chicken sold in markets of Kiambu County, Kenya", International Journal of Veterinary Science and Medicine, 2020

Publication

<1%

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off