

Journal of Biological and Chemical Research



An International Journal of Life Sciences and Chemistry

EISSN 2319-3077 ISSN 0970-4973



SJIF Scientific Journal Impact Factor

www.jbcr.in jbiolchemres@gmail.com info@jbcr.in

Global Impact Factor: **0.756**, Scientific Journal Impact Factor: **3.285**, IC Value: **6.01**

Scope

Life Sciences (Botany and Zoology), Medical Sciences, Chemical Sciences, Agricultural Sciences, Biochemical Sciences, Environmental Sciences, Biotechnology, Molecular Biology and Tissue Culture

Prof. Abbas Ali Mahdi

Editor General

Prof. Y.K. Sharma

Executive Chief Editor

Dr. M.M. Abid Ali Khan

Chief Editor

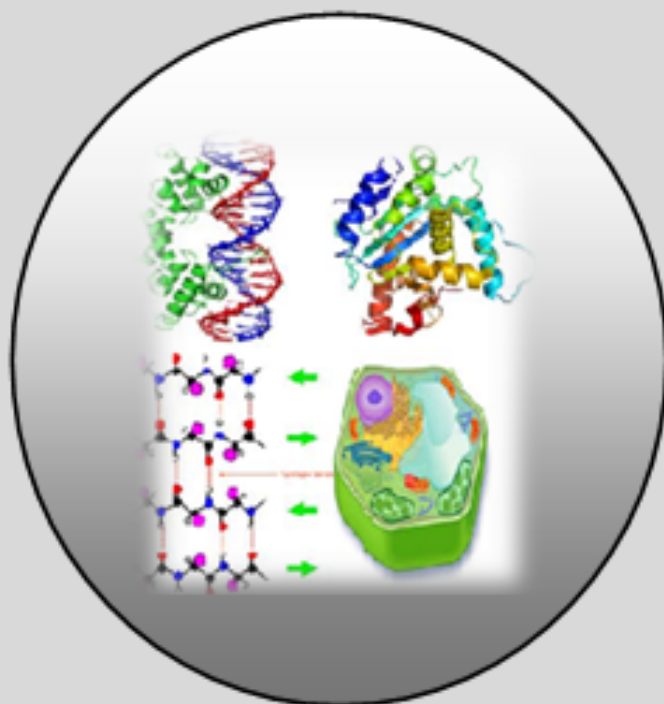
Dy. Chief Editors

Dr. John K. Grandy
(USA)

Dr. Dilfuza Egamberdieva
(Uzbekistan)

Dr. T.S. Naqvi (India)

Dr. Raaz Maheshwari (India)



Indexed, Abstracted and Cited

Index Copernicus International (Europe), Research Bible (Japan), Scientific Journals Impact Factor Master List, Directory of Research Journals Indexing (DRJI), Indian Science In, Database Electronic Journals Library (Germany), Open J-Gate, J Gate e-Journal Portal, Info Base Index, International Impact Factor Services (IIFS) (Singapore), Scientific Indexing Services (USA), International Institute of Organized Research (I2OR), Eye Source and citefactor.org Journals Indexing Directory, Indexing of International Research Journals

Published by Society for Advancement of Sciences®

1. Assessment of the Quality Characters of Some Promising Arabica Coffee Hybrids under Jimma-Tepi Environments in Southwestern Ethiopia

By - Fekadu Tefera, Sentayehu Alamerew and Dagne Wegary

[View & Download](#) | 1-6

2. GGE Biplot to Evaluate Arabica coffee (Coffee arabica L.) Hybrids for Genotype × Environment Interaction and Yield Stability in Mid-Lowland Agro-ecologies, Southwestern Ethiopia

By - Fekadu Tefera, Sentayehu Alamerew and Dagne Wegary

[View & Download](#) | 7-15

3. Coffee Value Chain Analysis in Limmu Seka District, Jimma Zone of Oromia National Regional State, Ethiopia

By - Gemechu Degefa Yadata, Alemayehu Biru Adeba Gemechu and Amsalu Mitiku Bora

[View & Download](#) | 16-31

4. Synthesis of Activated Carbons from Plastic Waste and Elimination of Rhodamine B in Batch Mode

By - A.B. Boukongou, T. Andzi Barh and P.R. Ongoka

[View & Download](#) | 32-43

5. Impact of Watershed Interventions on Soil Physico Chemical Properties in Kechi Micro-Watersheds of Kechi District, Dawuro Zone, of Ethiopia

By - Gemechu Fufa, Nigatu Abera and Barena Adare

[View & Download](#) | 44-52

6. Analysis of Onion Value Chain in Sebata Hawas, Special Woreda Zone of Oromia Surrounding Finfinne, Ethiopia

By - Sekata Gure, Gemechu Degefa, Bazhib Iman and Amsalu Mitiku

[View & Download](#) | 53-89

7. Diversity of Fern Plants on the Track to Gitgit Waterfall, Sukasada, Buleleng

By - I Ketut Ginantra, Made Gari and A. A. Ketut Darmadi

[View & Download](#) | 90-96

8. Natural and Synthetic Compounds as Treatment Alternatives for COVID-19: A Current Review

By - Kirubel Teshome Tadele and Temesgen Orebo Abire

[View & Download](#) | 97-107

9. Witnessing the Ring of Fire: Annular Solar Eclipse June 21, 2020 - From the Eyes of an Amateur

By - Amritanshu Vajpayee, Mohan Ram Inaniyan, Gajendra Gepala, Swapnil Rastogi, Upma Singh and Raaz K. Maheshwari
[View & Download](#) | 108-115

10. Climate Change Related Sea-Level Rise (SLR) Impacts on Social, Economic and Environmental Sectors and Adaptation Measures: A Short Review

By - Golam Kibria, A.K. Yousuf Haroon and Dayanthi Nugegoda
[View & Download](#) | 116-125

11. Community Perception and Awareness of Climate Change and Pollution in a 'Hot Spot' Country- Myanmar (Burma): A Preliminary Research Investigation

By - Golam Kibria
[View & Download](#) | 126-144

12. Identification of Natural Chemical Inhibitors against SARS-Associated Coronavirus

By - Gurusamy Chelladurai
[View & Download](#) | 145-148

13. Effects of Different Moisture Regimes on the Roots Activities of Soybean in Relation to Bradyrhizobium japonicum Bacteria

By - Hamid Kheyrodin
[View & Download](#) | 149-160

Diversity of Fern Plants on the Track to Gitgit Waterfall, Sukasada, Buleleng

By

I Ketut Ginantra, Made Gari and A. A. Ketut Darmadi

ISSN 2319-3077 Online/Electronic

ISSN 0970-4973 Print

Index Copernicus International Value

IC Value of Journal 82.43 Poland, Europe (2016)

Journal Impact Factor: 4.275

Global Impact factor of Journal: 0.876

Scientific Journals Impact Factor: 3.285

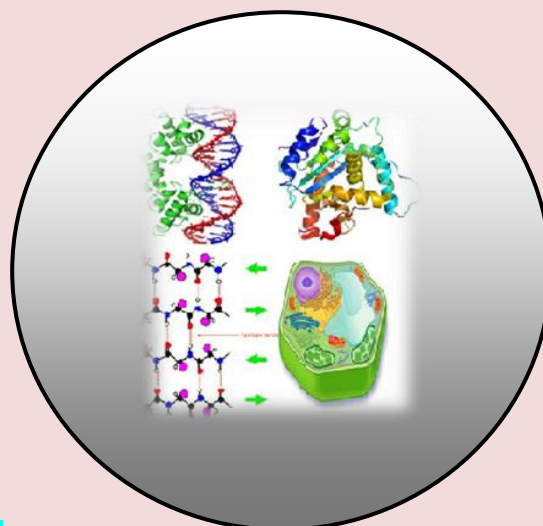
InfoBase Impact Factor: 3.66

J. Biol. Chem. Research

Volume 38 (1), 2021 Pages No. 90-96

Journal of Biological and Chemical Research

An International Peer Reviewed / Referred Journal of Life Sciences and Chemistry



Indexed, Abstracted and Cited in various International and National Scientific Databases

Published by Society for Advancement of Sciences®



I. Ketut Ginantra

[http:// www.sasjournals.com](http://www.sasjournals.com)

[http:// www.jbcr.co.in](http://www.jbcr.co.in)

jbiolchemres@gmail.com

RESEARCH PAPER

Received: 31/01/2021

Revised: 09/02/2021

Accepted: 10/02/2021

Diversity of Fern Plants on the Track to Gitgit Waterfall, Sukasada, Buleleng

I Ketut Ginantra, Made Gari and A. A. Ketut Darmadi

Biology Study Program, Faculty of Mathematics and Natural Sciences,
Udayana University, Bali, Indonesia

ABSTRACT

*Study on the diversity of ferns has been carried out along the route to the Gitgit waterfall Sukasada Buleleng. The research was conducted in January-March 2019. The method used in this study was the line transects method, 2 meters wide and 3 sub-lanes with 243 meters each. So, the research area is 1,458 m² (2 m x 3 x 243 m). Identification of ferns based on leaf morphological characters, leaf arrangement on stems, stem shape and color, sporangium position. The results showed that in the Gitgit waterfall area, there were 22 species of ferns belonging to 13 genera and 10 families. The most dominant species found were from the Pteridaceae family. Four species of ferns were found relatively dominant based on their importance value on the track to the Gitgit Waterfall, namely *Adiantum philipense*, *Adiantum raddianum*, *Deparia petersenii* and *Pteris longipinnula*. Based on the moderate diversity index (Shanon-Wiener index 2.97) and the high evenness index (evenness index 0.96), the ecological condition of the track to Gitgit waterfall is good.*

Keywords: *Species Diversity, Ferns Species, Line Transect Method and Gitgit Waterfall Area.*

INTRODUCTION

The fern is one of the groups of Indonesian flora which has a high diversity and wide distribution. Fern plants are vascular plants that do not have seeds (vascular seedless). The diversity of Pteridophyta species found in an area can be an indicator of the environmental conditions of the area. The existence of Pteridophyta, as an ecosystem component, can indicate whether the environment supports the life of an organism or not because it has a reciprocal relationship and is interdependent with its environment. The role of ferns as pioneer plants is very important, such as balancing the forest ecosystem, namely as a prevention of erosion, regulating water content and helping the process of decaying forest litter (Nazihah *et al.*, 2018, Arini and Kinho, 2012).

Indonesia contributes significantly to the diversity of ferns in the world. Of the 13,000 species of ferns estimated to exist in the world, around 2,197 species were identified in Indonesia (Elizabeth *et al.*, 2014). In Bali, there are 173 species of ferns (Girmansyah *et al.*, 2013). The Flora of Bali records 165 species of ferns in Bali (Van Balgooy and Widjaja, 2014).

In general, ferns plant well in humid habitats, in general the number of ferns in mountainous areas is more than in lowlands, this is due to high humidity, high water flow, fog, and even the amount of rainfall that affects its kind. In addition to differences in height, there are also differences in tree variation, so that tree variations will also affect abiotic factors which in turn affect the diversity of ferns (Surfiana *et al.*, 2018, Nazihah *et al.*, 2018).

Several studies on the diversity of ferns in Bali have been carried out. Darma *et al.* (2018), found 24 species of epiphytic ferns in the area of Mount Tapak and Lesung Bedugul Bali. Adjie and Lestari have identified around 72 species of ferns in Bali. Putra *et al.* (2016) identified 11 species of ferns in the Dasong Tourism Forest, Buleleng (Ginantra *et al.*, 2015) have also examined one species of fern that has never been reported to be found in Bali, namely the *Helminthostachys zeylanica*. The results of this study found this species in the Bajera area of Tabanan Regency (Sujarwo *et al.* 2014) in an ethnobotany study, reported that there were 4 species of Edible Ferns Used in Bali.

The Gitgit waterfall area is in the Sukasada district, Buleleng regency, Bali. This area is located at an altitude of about 700 m above sea level. The Sukasada district area, especially Gitgit-Buyan-Tamblingan, has a relatively cooler climate, higher humidity and higher rainfall than other Buleleng areas, which is around 105 mm / month. Rainfall occurs every month or throughout the year with almost no dry months. The Gitgit Waterfall area and its surroundings are plantation areas, including coffee, cocoa and clove plantations (Sukasada District in Numbers, 2020).

Habitat conditions on the path to the Gitgit waterfall are humid, water flow, trees in plantations and forests, so that it supports the growth of diversity of nails. Data on the diversity of ferns in the waterfall area is important to know, considering that the presence of ferns is one component of the ecosystem, it can indicate whether the environment supports the life of an organism or not because it has a reciprocal relationship and is interdependent with its environment. In addition, the use of the path to the waterfall for tourism can affect the existence of plants, including ferns. So the focus of this research is to determine the diversity of species of ferns along the tracking path to the Gitgit waterfall.

MATERIALS AND METHOD

Study area and period

The research was carried out along the route to the Gitgit Waterfall, Sukasada District, Buleleng Regency, Bali, from January to March 2019. The length of the tracking path is 729 m, divided into 3 sub-lines (Figure 1). The research location is at coordinates 8°11'23.02"-8°11'23.30" S and 115°08'09.52"-115°08'05.83" E, altitude between 518-600 m above sea level. The path to the Gitgit waterfall is a plantation area, rice fields (Tea, Chocolate, Coffee) and rainforest.

Data collection technique

The data was collected by using the line transect method (Stiling, 1996), 2 meters wide and 3 sub-lanes with a length of each lane is 243 meters. So, the research area is 1,458 m² (2 m x 3 x 243 m). The number of clumps of nails found in each lane is recorded (one clump of ferns is counted as one individual). Each species was photographed for identification. Identification of fern species based on leaf morphological characters, leaf arrangement on stems, shape and color of stems, position of sporangium, identification refers to Flora Indonesian, Fern of Bali (Adjie and Lestari, 2011).

Data analysis

Data on the number of clumps and the presence of ferns in the 3 sub-lines along the tracking line were calculated to determine the importance value of each species. Furthermore, the importance value of fern species is based on the sum of the relative density and relative frequency of each species. The plant diversity index (H) uses the Shannon-Wiener index, $H = -\sum (ni / N) \times \ln (ni / N)$, which *ni* is the important value of the species-*i* and *N* is the total important value of all species. The evenness index is $H / \ln S$, where *S* is the number of species (Stiling, 1996).

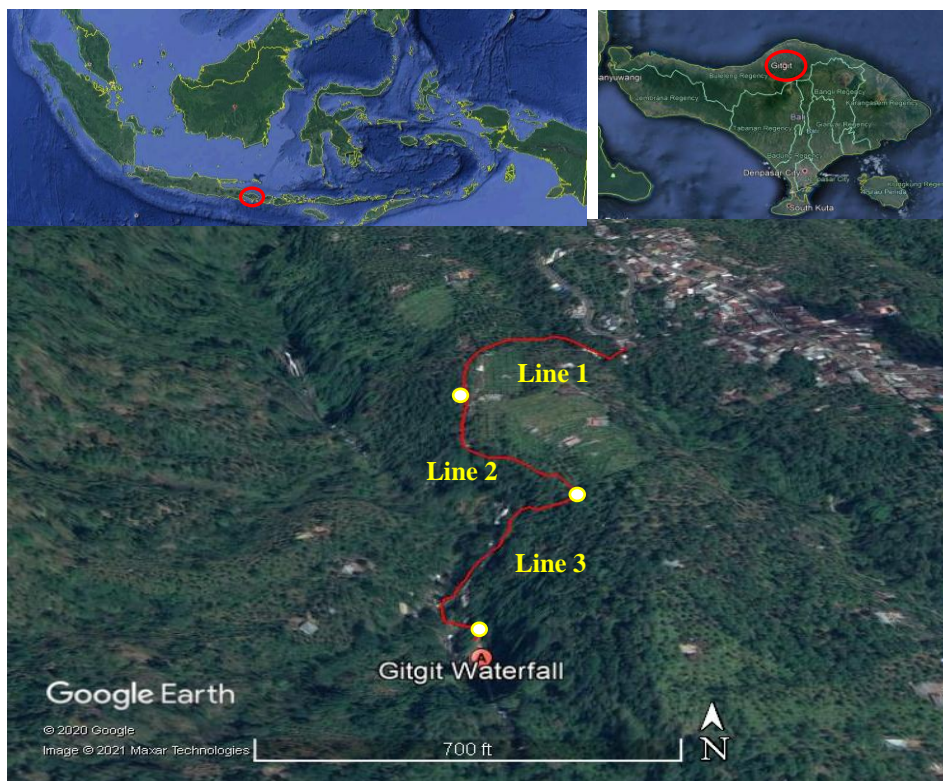


Figure 1. Map of fern plant study locations.

RESULTS AND DISCUSSION

The results of the research in the Gitgit waterfall area found 22 species of ferns, consisting of 13 genera and 10 families. The most dominant species from the Pteridaceae family were found, namely 6 species (Table 1). Four species of ferns are relatively dominant based on their importance on the path to the Gitgit waterfall, namely *Adiantum philipense*, *Adiantum raddianum*, *Deparia petersenii* and *Pteris longipinnula*. These species have a high frequency of presence along the line (on 3 lines). The four species grow on the ground, under the shade of other plants and around rocks where conditions are quite humid. *Cyathea latebrosa* tree species are not widely found, only a few individuals around the waterfall. *Pyrrosia lanceolata* species are epiphytic fern found by several individuals attached to cacao and *Zyzigium* plants in line 2 (the path through the plantation). Most of the species of ferns found in the Gitgit waterfall area are species of ferns that have been recorded in the fern of Bali by Adjie and Lestari (2011).

Environmental conditions in the Gitgit waterfall area, namely high soil moisture, high humidity, temperature range between 22-28 °C, light intensity that is not too high because of the shade that supports the growth of various types of nails (Imaniar *et al.* 2017) conducted research in the area of Kapas Biru Waterfall, Pronojiwo District, Lumajang Regency, stating that areas with high humidity (air humidity around 80 %), soil humidity at 50 %, the presence of shade so that light intensity is not too high, temperature range 21-27 °C is very supportive for the growth of species diversity of ferns. The condition of the Kapas Biru Lumajang waterfall area is somewhat similar to the conditions in the area leading to the Gitgit waterfall, so the richness of the species of ferns is also high.

Table 1. Species diversity of ferns along the tracking path to Gitgit Waterfall.

No.	Species	Family	Distribution of ferns in the tracking lines			Importance value
			Line 1	Line 2	Line 3	
1	<i>Adiantum concinnum</i>	Pteridaceae	-	√	√	10.53
2	<i>Adiantum philipense</i>	Pteridaceae	√	√	√	21.61
3	<i>Adiantum raddianum</i>	Pteridaceae	√	√	√	18.13
4	<i>Cyathea latebrosa</i>	Cyatheaceae	-	-	√	5.27
5	<i>Deparia petersenii</i>	Athyriaceae		√	√	14.02
6	<i>Diplazium esculentum</i>	Athyriaceae	-	√	√	9.37
7	<i>Dryopteris sparsa</i>	Dryopteridaceae	-	-	√	6.43
8	<i>Lygodium microphyllum</i>	Lygodiaceae	√	-	-	5.27
9	<i>Lygodium sp.</i>	Lygodiaceae	√	-	-	5.27
10	<i>Microlepia speluncae</i>	Dennstaedtiaceae	-	√	√	5.27
11	<i>Nephrolepis biserrata</i>	Lomariopsidaceae	√	√	√	5.27
12	<i>Nephrolepis exaltata</i>	Lomariopsidaceae	√	-	-	5.27
13	<i>Nephrolepis sp1.</i>	Lomariopsidaceae	√	-	-	5.27
14	<i>Pteridium sp.</i>	Dennstaedtiaceae	√	-	-	6.43
15	<i>Pteris biaurita</i>	Pteridaceae	-	√	√	11.70
16	<i>Pteris longipinnula</i>	Pteridaceae	-	√	√	15.80
17	<i>Pteris vittata</i>	Pteridaceae	√	-	-	11.70
18	<i>Pyrosia lanceolata</i>	Polypodiaceae	-	√	-	7.59
19	<i>Selaginella delicatula</i>	Selaginellaceae	-	√	√	11.70
20	<i>Selaginella plana</i>	Selaginellaceae	-	-	√	6.43
21	<i>Tectaria coadunata</i>	Tectariaceae	√	-	-	6.43
22	<i>Tectaria sp.</i>	Tectariaceae	√	√	-	5.27
Diversity index (H)						2.97
Evenness index (E)						0,96

Based on the Shannon-Wiener index, the diversity of ferns on the path to the Gitgit waterfall is in the medium category ($H = 2.97$), the evenness index value is 0.96. This shows that the ecological condition of the tracking path to the Gitgit waterfall is still quite good. This is because 22 species of ferns were found in the research area of 1.458 m², with a medium diversity index and a high evenness index.

The existence of different species of ferns with their respective morphological characteristics (Figure 2), namely the arrangement of the leaves, the layout of the leaves on the twigs, the shape of the leaves, the position of the sporangium, the color of the branches are very interesting to observe and become objects of environmental education for visitors to the Gitgit waterfall area. The diversity of species with their unique characteristics becomes the object of introduction to the richness of flora for visitors. The existence of ferns on the slope of the soil on the path to the Gitgit Waterfall is important in maintaining soil stability, because the root system is able to glue / hold the soil so that it is not easily eroded when the rainwater is high (Rizky *et al.* 2018) stated that ferns have a high ecological value as understorey, which plays a role in the formation of nutrients from the resulting litter, as soil cover and prevents soil erosion.



Adiantum concinnum



Adiantum philippense



Adiantum raddianum



Deparia paterseii



Diplazium esculentum



Dryopteris sparsa



Lygodium microphyllum



Lygodium sp.



Microlepia speluncae



Figure 2. Species of ferns in the tracking path Gitgit Waterfall, Sukasada, Buleleng.

CONCLUSION

In the Gitgit waterfall area, 22 species of ferns were found, including 13 genera and 10 families. The most dominant species found were from the Pteridaceae family. The ecological conditions of the path to the Gitgit Waterfall are classified as good, based on a moderate diversity index (Shanon-Wiener index 2.97) and a high species evenness index (evenness index 0.96).

ACKNOWLEDGMENTS

We would like to thank Ni Wayan Ari Sukarmini, Ni Putu Intan Maharani and I Kadek Teja Mahendra, who have helped with sample collection in the field.

REFERENSSES

- Adjie, B. and W.S. Lestari (2011).** Flora Indonesian, Ferns of Bali. Bali Botanic Garden, Indonesian Institute of Sciences, Baturiti, Tabanan, Bali, Indonesia – 82191 available at <http://www.krbali.lipi.go.id>
- Arini, D.I.D and J. Kinho (2012).** The Pteridophyta Diversity in Gunung Ambang Nature Reserve North Sulawesi. Info BPK Manado Volume 2 No 1, 18-40.
- Darma, I.D.P., W.S. Lestari, Arief Priyadi and R. Iryadi (2018).** *Epiphytic Ferns and Phorophyte Trees in the Hills of Pengelengan, Tapak and Lesung. Jurnal Penelitian Hutan dan Konservasi*, Vol. 15 No. 1, 41-50.
- Elizabeth, A., Widjaja, Y. Rahayuningsih, J.S. Rahajoe, R. Ubaidillah, I. Maryanto, E.B. Walujo dan G. Semiadi (2014).** Indonesian Biodiversity Presentation 2014. Indonesian Institute of Sciences (LIPI), Center for Biological Research. Available at: <http://penerbit.lipi.go.id/data/naskah1432194926.pdf>.
- Ginantra, I.K., A.A.K Darmadi and M. Joni (2015).** Existence and Morphology Characteristics of Tunjuk Langit Fern (*Helminthostachys zeylanica* Hook.) in Bali. *Journal of Biological and Chemical Journal Research*. Vol. 32, (2): 733-739.
- Girmansyah, D., Y. Santika, and A. Retnowati (2013).** Flora of Bali: An Annotated Checklist. Penerbit Yayasan Pustaka Obor Indonesia, Jakarta.
- Imaniar R., Pujiastuti and S. Murdiyah (2017).** Identification of the Diversity of Fern Plants in the area of Kapas Biru Waterfall, Pronojiwo District, Lumajang Regency and Its Use as a Booklet. *Jurnal Pendidikan Biologi*, Vol. 6, No. 3, Edisi.
- Nazihah, I., M. Shahir Zaini, R. Shahari, C.N.A.C Amri and N. M. Tajudd (2018).** Diversity and Distribution of Fern Species in Selested Trail in Kuantan Pahang. *Science Heritage Journal (GWS)* 2(1) (2018) 04-09.
- Surfiana, S. Kamal and M. Hidayat (2018).** Plant Diversity of Ferns (Pteritophyta) Base on Altitude in the Ecosystem Area of Lake Aneuk Laot, Sabang. *Prosiding Seminar Nasional Biotik*. ISBN: 978-602-60401-9-0.
- Putra, I.P.G. H. Putra, I.W S.Warpala dan I.G.A.N., Setiawan (2016).** Plant Diversity of Ferns (Pteridophyta) in the Tourism Forest of Dasong, Sukasada, Buleleng. *Jurnal Pendidikan Biologi Undiksha*. Vol. 3, No 2.
- Rizky, H., R. Primasari, Y. Kurniasih dan D. Vivanti (2018).** Plant Diversity of Terrestrial Fern in the Forest with Special Purpose (KHDTK) Banten. *BIOSFER*, Vol.3, No.1.
- Stiling, P. (1996).** Ecology, Theories and Applications. Prentice Hall International Inc. New Jersey.
- Sukasada District in Numbers (2020).** Central Bureau of Statistics of Buleleng Regency. Available at: <https://bulelengkab.bps.go.id>
- Sujarwo, W., I.N. Lugrayasa and G. Caneva (2014).** Ethno botanical Study of Edible Ferns Used in Bali Indonesia. *Asia Pacific Journal of Sustainable Agriculture Food and Energy (APJSAFE)*, Vol. 2 (2): 1-4.
- Van Balgooy, M.M. J and E.A. Widjaja (2014).** Flora of Bali: A Provisional Checklist. REINWARDTIA Vol. 14, No 1, pp: 219 – 221.

Corresponding author: I Ketut Ginantra, Biology Study Program, Faculty of Mathematics and Natural Sciences, Udayana University, Bali, Indonesia

Email: ketut_ginantra@unud.ac.id