Pharmacogn J. 2020; 12(5): 993-999
A Multifaceted Journal in the field of Natural Products and Pharmacognosy
www.phcogj.com

Original Article

# Antifungal Activity of Neolignan Derivatives from *Eusideroxylon zwageri* Against Pathogenic Fungus *Microsporum gypseum*

**Anis Yohana Chaerunisaa[1,*], Muhaimin Muhaimin[2,3], Syamsurizal Syamsurizal[2,3], Harizon Harizon[2], Tiana Milanda[4], Imam Adi Wicaksono[5]**

**ABSTRACT**

**Introduction:** Bulian wood (*Eusideroxylon zwageri*) known as iron wood. It was known as wood source which fungi and insect resistant. These effects were interconnected with secondary metabolites contained within. **Methods:** *Eusideroxylon zwageri* wood powder was macerated with methanol and fractinated with n-Hexane, dichloromethane, ethyl acetate. Eusiderin I and Compound B were isolated from n-hexane fraction, while Compound C were isolated from dichloromethane fraction. Eusiderin I, compound A and Compound B were characterized using melting point, UV spectroscopy and compared with previous data. Antifungal activity test was conducted with *Microsporum gypseum* using paper disc method. **Results:** A research on antifungal activity of Neolignan derivatives from *Eusideroxylon zwageri* against pathogenic fungus *Microsporum gypseum* had been carried out. Eusiderin I, Compound B and Compound C were isolated from wood of *Eusideroxylon zwageri*. All three compounds are white crystals with melting point in such 99-100 °C, 110-112 °C, 98-99 °C, respectively and UV spectrum data is similar to reference. The antifungal activity test of Eusiderin I, Compound B and Compound C from Bulian wood (*Eusideroxylon zwageri*) to phatogen fungus of *Microsporum gypseum* showed that with five different concentrations (5, 25, 50, 100 and 200 ppm), Eusiderin I was a potent antifungal because it had a strong activity in inhibiting the *Microsporum gypseum* growth. The 5 days incubation test result showed that 50 ppm Eusiderin I could inhibit the *Microsporum gypseum* colony growth. The 100 ppm Eusiderin I gave the most effective inhibition precentage because it could inhibit the *Microsporum gypseum* colony growth (= 93.9%). **Conclusion:** Based on this data, Eusiderin I can be indicated an antifungal candidate.
**Key words:** *Eusideroxylon zwageri*, *Microsporum gypseum*, Eusiderin, Antifungal.

**Anis Yohana Chaerunisaa[1,*], Muhaimin Muhaimin[2,3], Syamsurizal Syamsurizal[2,3], Harizon Harizon[2], Tiana Milanda[4], Imam Adi Wicaksono[5]**

*[1]Department of Pharmaceutic and Pharmaceutical Technology, Faculty of Pharmacy, Padjadjaran University, Jatinangor, 45363, INDONESIA.*
*[2]Department of Chemistry Education, Faculty of Education, University of Jambi, Jambi, 36361, INDONESIA.*
*[3]Department of Chemistry, Faculty of Science and Technology, University of Jambi, Jambi, 36361, INDONESIA.*
*[4]Department of Pharmaceutical Biology, Faculty of Pharmacy, Padjadjaran University, Jatinangor, 45363, INDONESIA.*
*[5]Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Padjadjaran University, Jatinangor, 45363, INDONESIA.*

**Correspondence**

**Anis Yohana Chaerunisaa**

Department of Pharmaceutic and Pharmaceutical Technology, Faculty of Pharmacy, Padjadjaran University, Jatinangor, 45363, INDONESIA.

E-mail: anis.yohana.chaerunisaa@unpad.ac.id

**History**

- Submission Date: 28-04-2020;
- Review completed: 25-05-2020;
- Accepted Date: 09-06-2020.

**DOI : 10.5530/pj.2020.12.140**

**Article Available online**

http://www.phcogj.com/v12/i5



## INTRODUCTION

Bulian wood (*Eusideroxylon zwageri*) known as iron wood, is one of Lauraceae popular as furnished and kitchenettes wood. It was known as wood source which fungi and insect resistant. Its fruits used as antiinflammatory agent. These effects were interconnected with secondary metabolites contained within.[1-3]

There are four big metabolites group produced by *Eusideroxylon zwageri*. They are alkaloid, steroid, terpenoid and phenolic compounds.[4] Among all that, Stilbene derivative phenolic compounds have fungicide and insecticide activity.[5,6] It was estimated that these compounds can protect bulian wood from insect and wood decay fungi.[7-9]

Earlier research found that *Eusideroxylon zwageri* have five pure compounds, three of them are neolignan and two are aporphin alkaloid and phenantrene. Three of neolignan indentified as Eusiderin I, Compound B and Compound C.[10-12] Eusiderin compounds have activity as antifungal against wood decay fungus.

Indonesia has a tropical climate, this causes fungi and bacteria to proliferate easily. *Microsporum gypseum* is a fungus that causes skin diseases in humans.[3] Parts of human body that are often moist can easily be infected by pathogenic fungi. One of the most infectious pathogenic fungi is *Microsporum gypseum* which causes ringworm. To prevent this disease from spreading it is necessary to find new skin fungal drugs. This drug is expected to be more effective and safe for human and the environment. One of the natural antifungals produced by bulian wood can be used. Eusiderin from bulian wood can inhibit the growth of wood decay fungi.[11] So that it is expected to also be used to inhibit the growth of the *Microsporum gypseum* fungus. In this paper, the results of a study of the effectiveness of eusiderin compounds in inhibiting the growth of the *Microsporum gypseum* fungus are reported.

## MATERIAL AND METHODS

### Materials

*Eusideroxylon zwageri* wood was collected from Jambi – Indonesia in May 2017. Other materials used in this experiments are *Microsporum gypseum*, Potato Dextrose Agar (PDA), Eusiderin I, Compound B and Compound C, ethanol, methanol, aceton, DMSO, Silica gel for column chromatography, Silica gel for vacuum liquid chromatography, thin layer chromatography plate and chemicals for antifungal activity test.

**Cite this article:** Chaerunisaa AY, Muhaimin M, Syamsurizal S, Harizon H, Milanda T, Wicaksono IA. Antifungal Activity of Neolignan Derivatives from *Eusideroxylon zwageri* Against Pathogenic Fungus *Microsporum gypseum*. Pharmacogn J. 2020;12(5):993-9.

The test species and isolate used for this investigation was *Microsporum gypseum*. Identification of isolate obtained was performed according to standard methods.[3,11]

### Preparation of extracts: Extraction and partition of *Eusideroxylon zwageri* wood powder

10 Kg of *Eusideroxylon zwageri* wood powder was macerated with methanol and fractinated with n-Hexane, dichloromethane, ethyl acetate. n-Hexane and dichloromethane fractions was applied to Vacuum Liquid Chromatography, then Column Chromatography and Thin Layer Chromatography. Eusiderin I and Compound B were isolated from n-hexane fraction, while Compound C were isolated from dichloromethane fraction. The structure analysis was conducted by UV and IR Spectroscopy and compare than literature.[11,13-16]

### Minimum inhibitory concentration (MIC)

MIC determination of Eusiderin I against *Microsporum gypseum* were performed by using paper disc diffusion method. The samples were disolved in DMSO using a certain ratio and were mixed with liquid PDA in a sterile petri dish. Petri dish were shaken until the mixture becomes homogeneous, and solidify at room temperature. Suspension of *Microsporum gypseum* then were introduced using a wire loop. All petri dishes then were incubated at 30 °C for 5 days. Colony growth of *Microsporum gypseum* were observed.[3,11]

### *In vitro* antifungal activity assay

Antifungal activity test was conducted with *Microsporum gypseum* as pathogen fungi using paper disc diffusion method.[17,18] Twenty milliliter of sterilized Potato dextrose agar medium was poured into a 15 cm Petri dish. Twenty microliter of inoculums suspension of each test organism was distributed evenly over the surface. Paper disc (6 mm) was put in plate using the wide-end of a sterilized Pasteur pipette. Isolates (pure compound) of Eusiderin I, Compound B and Compound C were used in 5, 25, 50, 100 and 200 ppm concentrations. Fifty microliter of serial dilution of Eusiderin I, Compound B and Compound C and Ketoconazole were placed into paper discs. All assays were made in triplicate. The investigation were conducted by measuring colony growth diameter of *Microsporum gypseum*.[3,11]

The plates were incubated for 5 days at 30°C. Results of the qualitative screening were recorded as the average diameter of the inhibition zone surrounding the paper discs containing the test solution. Results were compared with Ketoconazole. The percentage of mycelia inhibition was calculated as follows:

$$\text{mycelia inhibition } (\%) = \left[\frac{dc - dt}{dc}\right] \times 100$$

dc: colony diameter in control, dt: colony diameter in treatment.

Three replicate plates were used for each treatment. The MIC was regarded as the lowest concentration that produced a visible zone of inhibition.[3]

### Statistical analyses

The comparison of average zone diameters and the evaluation of isolate antifungal effects were analyzed by SPSS 11.5 and t-test. In this experiment, P value was statistically significant ($P < 0.05$).

## RESULT AND DISCUSSION

### Neolignan derivative compounds from *Eusideroxylon zwageri*

There are four large groups of secondary metabolites produced by the *Eusideroxylon zwageri* T et B plant, namely groups of alkaloid compounds, steroids, terpenoids and phenolics.[4,10,11] Among the four groups of compounds, as is usual in other wood species, stilben derivative phenolic compounds and lignans have fungicidal and insecticidal properties. It is estimated that this class of compounds can protect bulian plants against the attack of termites and wood decay fungus. From previous studies, five pure compounds have been found in this plant, each of three neolignan derivative compounds and two aporfine and phenantren alkaloid derivatives. Three of these neolignan compounds has been identified as eusiderin I, Compound B and Compound C.[4,10,11] These all three neolignan compounds have antifungal activity against wood decay fungi. But how the biological role of these compounds in bulian wood against the attack of termites has never been studied. As well its bioactivity to other microorganisms. Structure Eusiderin I, Compound B and Compound C exhibited in Figure 1.

Eusiderin I, Compound B and Compound C are a benzodioxane type neolignan derivative which is biogenetically derived from the oxidation of p-allylphenol and p-propenylphenol followed by coupling the two free radicals of these compounds.[4,5,17]

Producing number of neolignan derivative compounds in this research carried out experimentally. Total of 10 kg of dried powder of bulian wood was macerated with methanol. The results of maceration obtained concentrated methanol extract of 1.15 kg. Furthermore, the methanol extract was fractionated with n-hexane, dichloromethane and ethyl acetate solvents. After going through several processes of separation and purification of the n-hexane fraction Eusiderin I and compound B obtained, and from the dichloromethane fraction C compounds obtained.

### Eusiderin I

Eusiderin I was isolated from fraction III.2 n-hexane extract. Eusiderin I was white crystals with a melting point of 99-100 °C. The UV spectrum in chloroform provides absorption at λmax (nm) 241 and 273. Uptake in the area λmax (nm) 241 is usually an unsaturated chromophore of substituted alkene whereas at λmax (nm) 273 it is usually a chromophore of an oxygenated aromatic system.[11,13,19-21] The complete data can be seen in Figure 2 below.

### Compound B

Compound B was isolated from fraction III.5 n-hexane extract. Compound B is the result of isolation in the form of white crystals with a melting point of 110-112 °C. The UV spectrum in chloroform provides absorption at λmax (nm) 210, 273 and 335. This absorption area is similar to eusiderin I which has been described previously. The complete data can be seen in Figure 3 below.

### Compound C

Compound C was isolated from fraction II.1 dichloromethane extract. Compound C from isolation is white crystal with a melting point of 98-99 °C. The UV spectrum provides absorption at λx (nm) 217 and 272 [11]. The complete data can be seen in Figure 4 below.

Based on melting point and UV spectra, compared to literature it is concluded that the isolated Bulian wood powder (*Eusideroxylon zwageri*) was truly Eusiderin I, Compound B and Compound C (Table 1).

### Antifungal activity

To determine the minimum inhibitory concentration (MIC) of Eusiderin I against *Microsporum gypseum,* antifungal activity were studied at different concentrations (0.625, 1.25, 2.5, 5 and 10 ppm) of samples. Minimum Inhibition Concentration (MIC) value was observed as lowest concentration effective in inhibition of fungal

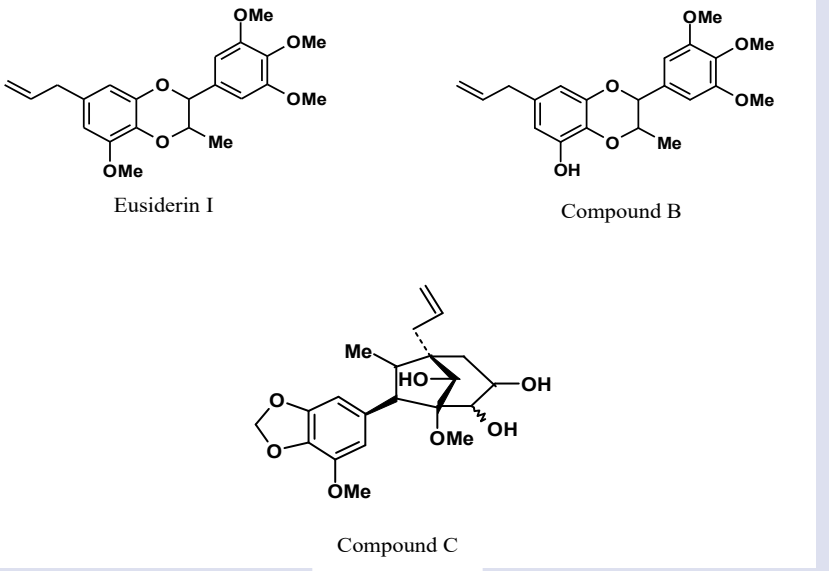



**Figure 1:** Structure of Eusiderin I, Compound B and Compound C.

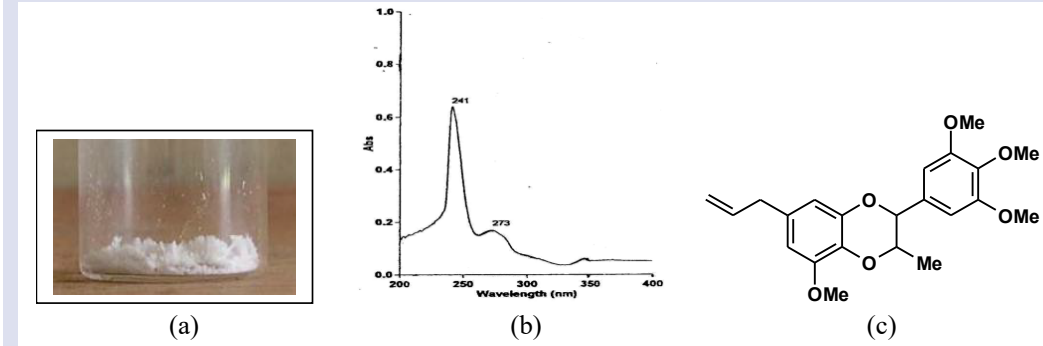



**Figure 2:** (a) Eusiderin I Crystals, (b) Eusiderin I UV Spectrum, and (c) Eusiderin I Structure.

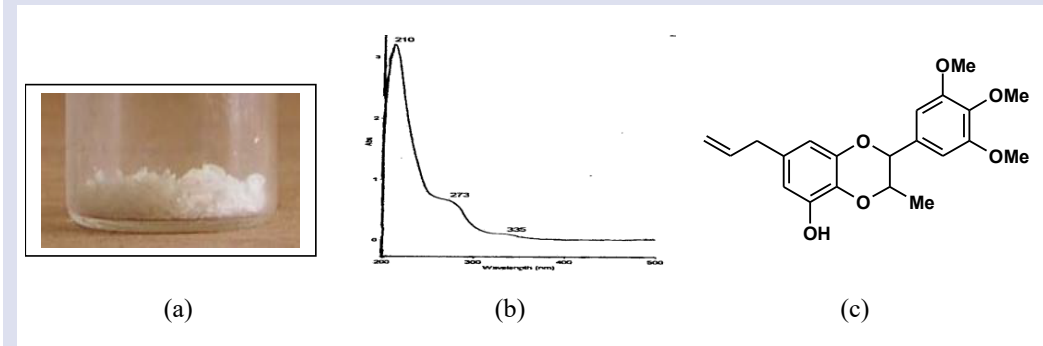



**Figure 3:** (a) Compound B Crystal, (b) Compound B UV Spectrum, and (c) Compound B Structure.

**Table 1: Previous Data and Research Data.**

| Compound | Melting point (mp) (°C) | | $\lambda_{max}$ UV Spectra (nm) | |
|---|---|---|---|---|
| | Previous Data | Research Data | Previous Data | Research Data |
| Eusiderin I | 99-100 | 99-100 | 241, 274 | 241, 273 |
| B | 110-113 | 110-112 | 209, 273, 335 | 210, 273, 335 |
| C | 98-101 | 98-99 | 219, 272 | 217, 272 |

growth. The results showed that MIC value of Eusiderin I against *Microsporum gypseum* was 5 ppm (Table 2).

Ketoconazole have been used a positive control, due to its activity as broad-spectrum antifungal agent having fungistatic and fungicidal effects. The negative control (DMSO) had no activity (data not shown). The results suggested that Eusiderin I 50 ppm was the $IC_{50}$ value in which the concentration capable to inhibit more than 50% of *Microsporum gypseum* growth. Therefore, Eusiderin I 50 ppm was assumed as the ideal concentration of which antifungal activity had potently inhibited the colony growth of *Microsporum gypseum*.

The antifungal activity test of Eusiderin I, Compound B and Compound C from Bulian wood (*Eusideroxylon zwageri*) to phatogen fungi *Microsporum gypseum* showed that with three different concentrations (5, 25, 50, 100 and 200 ppm), Eusiderin I was a potent antifungal because it had a strong activity in inhibiting the *Microsporum gypseum* growth (Table 3). The 5 days incubation test result showed that 50 ppm Eusiderin I could inhibit the *Microsporum gypseum* colony growth. The 100 ppm Eusiderin I gave the most effective inhibition precentage because it could inhibit the *Microsporum gypseum* colony growth (= 93.9%).

The results of antifungal activity test of Eusiderin I from Bulian wood (*Eusideroxylon zwageri*) exhibited in Figure 5.

The inhibitory effect into colony growth of *Microsporum gypseum* caused by Eusiderin I in triplicate (n = 3) shown in Table 3. It can be concluded that Eusiderin I in 100 ppm had the most effective inhibitory precentage against *Microsporum gypseum* colony (= 93.9%). These results indicated that allylic moiety group play an important role to enhance the antifungal activity. Meanwhile dioxane ring is necessary to maintain the conformation and stability.[3,10]

In this experiment, P value was statistically significant ($P < 0.05$). Therefore, such results of a significant value that confirms the therapeutic potency of some compounds used in traditional medicine. The effectiveness of inhibition is one of the criteria for selecting an antimicrobial compound for anti fungi. Damage caused by antimicrobial components can be mycosidal (permanent damage) and micostatic (temporary damage that can return). A component is micosidal or micostatic depending on the concentration and culture used.[3] Phenolic compounds interact with cell membrane proteins through an adsorption process involving hydrogen bonds by binding to the hydrophilic part of the cell membrane. Phenolic protein complexes are formed with weak bonds, so that they will immediately experience decomposition then followed by penetration of phenolic compounds into cells which cause precipitation and denaturation of cell membrane proteins. Damage to the cell membrane causes changes in permeability in the membrane, rsulting in the lysis of the fungal cell membrane.[3]

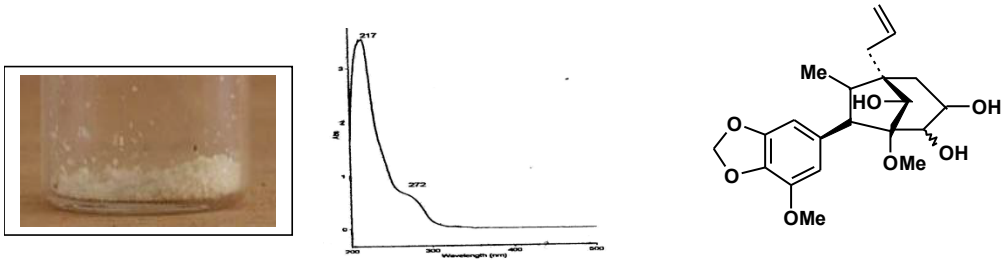



**Figure 4:** (a) Compound C Crystal, (b) Compound C UV Spectrum, and (c) Compound C Structure.

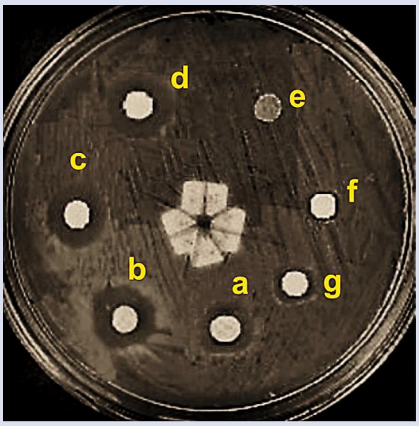



**Figure 5:** Antifungal activity of Eusiderin I, Compound B and Compound C from Bulian wood (*Eusideroxylon zwageri*) into *Microsporum gypseum* after 5 days of incubations. (Eusiderin I 50 ppm; b. Eusiderin I 100 ppm; c. Eusiderin I 200 ppm; d. Ketoconazole 200 ppm; e. DMSO; f. Compound B 100 ppm; and g. Compound C 100 ppm).

**Table 2: MIC of Eusiderin I against *Microsporum gypseum*.**

| Sub culture | Concentration (ppm) | Result |
|---|---|---|
| 1 | Media | - |
| 2 | Media + Sample | - |
| 3 | 10 | - |
| 4 | 5 | - |
| 5 | 2.5 | + |
| 6 | 1.25 | + |
| 7 | 0.625 | + |
| 8 | DMSO + Microsporum gypseum | + |
| 9 | Microsporum gypseum | + |

Annotation:
(-) : no colony growth were observed
(+) : colony growth were observed

**Table 3: Percentage of Colony Inhibitory Effect of Eusiderin I, Compound B and Compound C against *Microsporum gypseum*.**

| Compound | Mean of Percentage of Colony Inhibitory Microsporum gypseum ( r (%), n = 3) | | | | |
|---|---|---|---|---|---|
| | Concentration (ppm) | | | | |
| | 5 | 25 | 50 | 100 | 200 |
| Eusiderin I | 18.6 | 38.8 | 68.5 | 95.5 | 94.3 |
| | 19.8 | 38.5 | 69.1 | 93.2 | 94.2 |
| | 17.7 | 37.9 | 67.9 | 92.9 | 94.7 |
| Mean | 18.7 | 38.4 | 68.5 | 93.9 | 94.4 |
| Compoun B | 6.7 | 11.3 | 20.1 | 43.6 | 57.4 |
| | 8.1 | 12.1 | 19.8 | 43.2 | 58.3 |
| | 7.4 | 11.7 | 20.4 | 42.8 | 57.2 |
| Mean | 7.4 | 11.7 | 20.1 | 43.2 | 57.6 |
| Compound C | 11.6 | 20.6 | 41.6 | 60.2 | 73.8 |
| | 11.4 | 21.2 | 42.8 | 60.8 | 72.4 |
| | 11.2 | 22.1 | 41.3 | 61.4 | 73.2 |
| Mean | 11.4 | 21.3 | 41.9 | 60.8 | 73.1 |

The mechanism of inhibiting microorganisms by antimicrobial compounds can be caused by several factors, including (1) interference with the constituent cells of the cell, (2) increased permeability of cell membranes that can cause loss of cell constituent components, (3) inactivate enzymes and (4) destruction or damage to the function of genetic material.[11]

## CONCLUSION

The research had successfully tested antifungal activity of Eusiderin I, Compound B and Compound C from Bulian wood powder (*Eusideroxylon zwageri*) againts *Microsporum gypseum*. The 100 ppm Eusiderin I gave the most effective inhibition precentage because it could inhibit the *Microsporum gypseum* colony growth (= 93.9%). Eusiderin I can be indicated an antifungal candidate.

## ACKNOWLEDGEMENT

The authors are grateful to Directorate General and Higher Education, Ministry of Research, Technology and Higher Education Republic of Indonesia for supporting this project under Excellent Research of University on 2016.

## CONFLICTS OF INTEREST

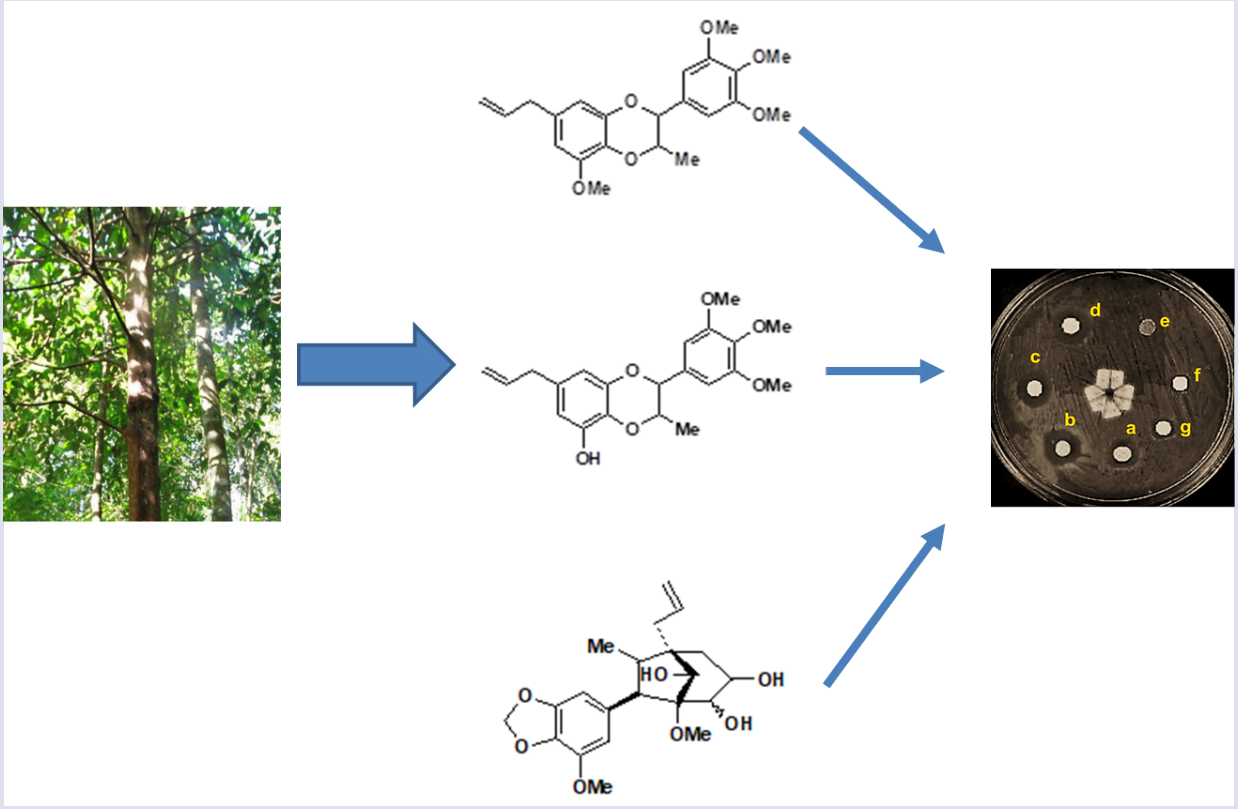
No conflicts of interest is associated with this work.

## REFERENCES

1. Hobbs JJ, King FE. The Chemistry of Extractives from Hardwoods. Eusiderin, a possible by-product of Lignin Synthesis in *Eusideroxylon zwageri*. J Chem Soc. 1960;1:4732-8.
2. Blanchette RA. Delignification by Wood-decay Fungi. Ann Rev Phytopathol. 1991;29:381-98.
3. Muhaimin M, Syamsurizal S, Latief M, Iskandar R, Chaerunisaa AY, Mujahidin D. Synthesis of 7,3′-Epoxy-8,4′-Oxyneolignane-1′-Carboxylic Acid from Natural Eusiderin A and its Activity Against *Trichophyton mentagrophytes*. Curr Organocat. 2020;7:44-54.
4. Chaerunisaa AY, Milanda T, Susilawati Y, Muhaimin M, Hendriani R, Subarnas A. Antibacterial activity and toxicological study of *Cassia fistula* on rats, Toxicology Report. 2020;7:649-57.
5. Miles HD, Maria M, Barbara AR, Shirley S. Insect Antifeedant from The Peruvian Plant *Alchornea triplinervia*. J Am Chem Soc. 1985;1:470.
6. Muhaimin M, Yusnaidar Y, Syahri W, Latief M, Putri RD, Utami A, *et al*. Antiplasmodial Activity of Ethanolic Extract of *Macaranga gigantea* Leaf and Its Major Constituent. Pharmacog J. 2019;11(6):1181-8.
7. Chaerunisaa AY, Milanda T, Susilawati Y. Activity of *Cassia fistula* L. Barks Fractions as Antibacterial Agent. J Pharm Sci & Res. 2018;10(2):304-9.
8. Boddy L. Importance of Wood Decay Fungi in Forest Ecosystem. Marcel Dekker, Inc. New York. 1991.
9. Moore E. Fundamentals of The Fungi, Fourth Edition, Prentice Hall International, Inc., New Jersey. 1996.
10. Merlini L, Zanarotti A. A Biogenetically Patterned Synthesis of (±) Eusiderin. Tetrahedron Lett. 1975;42:3621-2.
11. Muhaimin M, Syamsurizal S, Chaerunisaa AY, Sinaga MS. Eusiderin I from *Eusideroxylon zwageri* as antifungal agent against plant pathogenic fungus. Int J ChemTech Res. 2016;9(5):418-24.
12. Wasrin S, Samejima M, Yohimoto T. The role of Extractives in Decay Resistance of Ulin Wood (*Eusideroxylon zwageri*, T.et .B). Bull Tokyo Univ For. 1987;**77**:1-8.
13. Chaerunisaa AY, Muhaimin M. Comparative study on release of two drugs in fixed dose combination using zeroorder and first derivative spectrophotometry. Int J PharmTech Res. 2016;9(12):581-90.
14. Muhaimin M, Yusnaidar Y, Syahri W, Latief M, Utami A, Bemis R, *et al*. Screening and Potential Analysis of Methanolic Leaf Extract of Mangrove Plants at East Coast Sumatera as Repellent against *Aedes aegypti*. J Pharm Sci Res. 2018;10(9):2228-31.

15. Muhaimin M, Latief M, Putri RD, Chaerunisaa AY, Aditama AY, Pravitasari NE, *et al.* Antiplasmodial Activity of Methanolic Leaf Extract of Mangrove Plants against *Plasmodium berghei*. Pharmacog J. 2018;11(5):929-35.
16. Latief M, Utami A, Fadhilah N, Bemis R, Muhaimin M, Amanda H, *et al.* Antioxidant Activity from Perepat Plant (*Sonneratia alba*) Ethanol Leaf Extract with Cap-e Methods to Overcome Oxidative Stress in Thallasemia. J Pharma Sci Res. 2018;10(9):2160-2.
17. Pegg GF. Fungal Infection of Plants. Cambridge University Press, Cambridge. 1987.
18. Muhaimin M, Bodmeier R. Data on the application of the focused beam reflectance measurement (FBRM): A process parameters dataset for the ethyl cellulose (EC) microparticles preparation by the solvent evaporation method. Data in Brief. 2020;30:1-14
19. Abdelgaleil SAM, El-Aswad. Antifeedant and Growth inhibitory Effects of Tetranortriterpenoids Isolated from Three Meliaceous Species on the Cotton Leafworm, *Spodoptera littoralis* (Boisd). J App Sci Res. 2005;1(2):234-41.
20. Ismail IA, Abdel-Rahman RS. Economical evaluation of different treatments for Fig trees against long-horned Beetle, *Hesperophanes griseus* (Coleoptera: Cerambycidae). Int J ChemTech Res. 2016;9(4):122-5.
21. Muhaimin M, Bodmeier R. Effect of solvent type on preparation of ethyl cellulose microparticles by solvent evaporation method with double emulsion system using focused beam reflectance measurement. Polymer Int. 2017;66(11):1448-55.

## GRAPHICAL ABSTRACT




## ABOUT AUTHORS

**Anis Yohana Chaerunisaa**: Associate Professor at Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, Padjadjaran University, Jatinangor, Indonesia. She currently work on many research in the area of Pharmaceutical Technology and drug delivery including solid, liquid and semisolid dosage forms as well as developing polymer and other excipients for pharmaceutical dosage forms. She wrote dissertation on release adjustment of drug combined in one dosage form. She also has many experiences on drug discovery from herbals either as active compound or alternative for adjuvant therapy. She wrote many publications about her research on pharmaceutical dosage forms in many journals, as well as some books and book chapter. She is also pursuing interests on development of nanoparticles from synthesis and herbal active compounds.

**Muhaimin Muhaimin:** Associate Professor at Department of Chemistry Education, Faculty of Education, University of Jambi, Jambi, Indonesia. He has experience in the area of Organic Chemistry, Pharmaceutical Technology, and Pharmacognosy, working in drug delivery, drugs discovery of herbal plants, antimalaria and infectious disease. His research also focus on polymer and organic chemistry from mechanistic studies to synthetic methodology and the synthesis of natural products as well as of structurally intriguing heterocyclic compounds. The central focus of the research is the design of new methods for the synthesis of bioactive and synthetically versatile compounds. Other his research focus on innovative drug delivery systems with controlled drug release.

**Syamsurizal Syamsurizal:** Associate Professor at Department of Chemistry Education, Faculty of Education, University of Jambi, Jambi, Indonesia. He has experience in the area of Natural Product and Organic Chemistry.

**Harizon Harizon**: Associate Professor at Department of Chemistry Education, Faculty of Education, University of Jambi, Jambi, Indonesia. He has experience in the area of Natural Product and Organic Chemistry.

**Tiana Milanda**: Associate Professor at Department of Pharmaceutical Biology, Faculty of Pharmacy, Padjadjaran University, Jatinangor, Indonesia. Her research interest is about microbiology and biothechnology. She worked on molecular and genetic engineering for therapeutic purposes, and currently has been focused on finding the antimicrobial agent for resistant bacteria. She also doing the research on the development of antivirus from some herbals with the activity in inhibiting Neuraminidase receptors.

**Imam Adi Wicaksono:** Lecturer and Researcher at Department of Pharmacology and Clinical Pharmacy, Universitas Padjadjaran, Jatinangor, Indonesia. He has area of interest about biomolecular, microbiology and biotechnology. His molecular research is genetic engineering with recombinant DNA technology approach, gene expression, molecular activity mechanisms, in vivo and in vitro activities natural compound from medicinal plants. He is conducting a dissertation research about development of paper-based for aflatoxin B1 (AFB1) detection devices containing recombinant anti-AFB1 scFv protein with a recombinant DNA technology approach. He also focus on developing diagnostic kits for detection of cancer.

**Cite this article:** Chaerunisaa AY, Muhaimin M, Syamsurizal S, Harizon H, Milanda T, Wicaksono IA. Antifungal Activity of Neolignan Derivatives from *Eusideroxylon zwageri* Against Pathogenic Fungus *Microsporum gypseum*. Pharmacogn J. 2020;12(5):993-9.