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Antifungal Activity of the Some Mosses on Candida albicans

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Abstract: *Candida albicans* is one of the fungi that cause infectious diseases. The purpose of this research to investigate the activity of several species of the moss *Leucobryum aduncum*, *Meteorium subpolytrichum*, *Isotheciopsis comes*, *Homaliodendron flabellatum*, *Dicranoloma reflexum*, *Hyophila javanica*, and *Dicranella coarctata* against *C. albicans* ATCC 10231. Antifungal activity through diffusion and dilution test. The results showed that generally all the mosses extracts at different concentrations can inhibit the growth of *C.albicans* except in the methanol extract of *Homaliodendron flabellatum*, *Dicranoloma reflexum* and n-hexane extract *Dicranella coarctata*. The highest inhibition zone diameter was produced by n-hexane extract of *L. aduncum*.

Keywords : antifungal, C. albicans, mosses.

Introduction

Infectious diseases caused by microorganism. Microbial pathogens include bacteria, fungi, viruses, protozoa, and worms¹. One of the fungi that cause infectious diseases is *Candida albicans*. Some diseases caused by Candida albicans is thrush², lesions on the skin³, vulvavaginistis⁴, Candida in the urine (candiduria)⁵, gastrointestinal candidiasis which can cause gastric ulcers⁶ or it can even become cancerous⁷.

During this treatment of diseases using synthetic antibiotics, but the use of antibiotics with a resulting high frequency resistance⁸. Exploration of the natural ingredients that contain antimicrobial materials are needed⁹.Plants that have antifungal prospects are mosses. Extract of the moss Bryum argentium with ethanol solvent can inhibit the growth of fungi *Curvularia lunata* at a concentration of 10-100%¹⁰. Extract of the moss *Palustriella commutata* moss (Hedw.) Ochyra with solvent acetone and methanol are also can able to inhibit the growth of *Candida albicans*¹¹. Mosses (Bryophyta) potential as an antifungal to inhibit the growth of many types of fungi¹²

Several species of the mosses exploration results from the Cangar forest such as *Leucobryum aduncum*, *Meteorium subpolytrichum*, *Isotheciopsis comes*, *Homaliodendron flabellatum*, *Dicranoloma reflexum*, *Hyophila javanica*, and *Dicranella coarctata* have the prospect to be developed as an antifungal ingredient. The purpose of this research to investigate antifungal activity several species of the mosses on *Candida albicans* ATCC 10231.

Experimental

The plant material

The plant material from Cangar forest, Batu, Indonesia. The mosses *Leucobryum aduncum, Meteorium subpolytrichum, Isotheciopsis comes, Homaliodendron flabellatum, Dicranoloma reflexum, Hyophila javanica,* and *Dicranella coarctata*. The moss has been identified in the Laboratory of Plant Physiology, Department of Biology, Faculty of Science and Technology, Airlangga University, Surabaya, Indonesia.

Fungi pathogenic

Fungal pathogen *Candida albicans* ATCC 10231, which is derived from the Laboratory of Microbiology, Department of Biology, Faculty of Science and Technology, Airlangga University, Surabaya, Indonesia. *Candida albicans* are cultured in media Potatoes Dextrose Agar (PDA).

Preparation of the extract

All of the mosses are washed with running water until clean to separate it from the rest of the land attached, then all of moss leaves are dried, after which the leaves moss in small pieces like powder and inserted into each bottle containing n- hexane, ethyl acetate, and methanol soplvent. After two days, the extract solution each moss is separated from the pulp using filter paper. Next create a wide range of concentrations (10%, 25%, 50%, 75% and 100%) of the extract solution all the mosses.

Dilution test

Dilution test was done by making a mixture of 1 ml culture of *Candida albicans* and 1 ml of the extract solution with a predetermined concentration (5%, 7.5%, 30%, 40%, 80% and 90%) in a test tube, after it was allowed to stand during the day. In this test a petri dish filled with 0.1 ml of a mixed solution that had been made previously, then add 15 ml MHA media and homogenized. While in the control treatment, a petri dish contains only 0.1 *Candida albicans* and 15 ml of media MHA.

Results and Discussion

Based on the results showed that generally all the mosses extracts at different concentrations can inhibit the growth of *C. albicans*, but in the methanol extract of *Homaliodendron flabellatum* and *Dicranoloma reflexum* and n-hexane extract of *Dicranoloma coarctata*. Inhibition of C. albicans at a concentration of 10%. The highest inhibition zone diameter was produced by n-hexane extracts of *L. aduncum* (Table 1).

Mosses	Diameter inhibition (mm)														
	n-Hexane extract (%)					Ethyl acetate extract (%)					Methanol extract (%)				
	10	25	50	75	100	10	25	50	75	100	10	25	50	75	100
L. aduncum	8,2	9,8	8,9	10,8	13,1	10,6	10,4	11,8	11,9	7,5	0	0	0	9,2	10,4
M. subpolytrichum	9,1	10	10,8	10,4	8,3	0	0	8,9	7,7	6	0	0	8,9	7,7	6
I.comes	10,9	8,6	10,6	6	6	0	0	11,2	6	6	11,3	10,9	12,3	12,6	10,7
H. flabellatum	0	0	0	0	8.5	0	0	0	0	10,3	0	0	0	0	0
D. reflexum	0	8,4	7,6	7,5	8,5	0	0	7,8	8,2	10,5	0	0	0	0	0
H. javanica	0	0	8,1	8,8	7,4	0	9	9,9	9,6	11	0	12,5	12,4	12	11,6
D. coarctata	0	0	0	0	0	0	0	8,2	6	6	8,5	9,0	11,6	9,9	11,0

Table 1. Inhibition of C. albicans ATCC 10231 growth by mosses

MIC and MBC of the mosses extract can be seen in Table 2.

Mosses	Extract									
	n-He	exane	Ethyl	acetate	Methanol					
	MIC (%)	MBC (%)	MIC (%)	MBC (%)	MIC (%)	MBC (%)				
L. aduncum	5	7,5	5	>7,5	60	70				
М.	5	7,5	30	>40	<30	30				
subpolytrichum										
comes	5	>7,5	30	>40	5	>7,5				
H. flabellatum	90	>90	90	>90	-	-				
D. reflexum	5	>7,5	30	>40	-	-				
H. javanica	30	>40	15	>20	45	15				
D. coarctata	-	-	30	>40	5	7,5				

Table 2. MIC of the moss extract against C. albicans

Based on table 2 indicate that n-hexane extract of *L. aduncum* have a better MIC value when compared with other extracts. Dichloromethane and methanol extract of leaves of *Mentha piperita*, leaves of *Arrabidaea chica*, leaves of *Rosmarinus officinalis*, seeds of *Syzygium cumini*, fruit of *Punica granatum*, and stem of *Tabebuia avellanedae* can inhibit the growth of *C. albicans*¹³. Tannin isolated from *Rhizophora apiculata* can inhibit *C. albicans*¹⁴. Likewise, coconut oil can inhibit *C. albicans*¹⁵.

Results of other studies indicate that the water extract ethanol (50:50) of *Hyperium hawae* can inhibit *C. albicans* ATCC 10231 ¹⁶. Alcohol and water extract of *Camellia sinensis*, *Allium cepa*, *Mentha piperita*, *Aloe vera*, and *Murraya koenigii* can inhibit *C. albicans* MTCC 183 ¹⁷. The extract n-hexane, acetone and methanol of *Psidium guajava* can inhibit *C. albicans* ¹⁸. 95% ethanol extract of *Achillea santolina*, *Salvia officinalis* and *Salvia dominica* can inhibit *C. albicans* ¹⁹. Alcoholic extract of leaves of *Camellia sinensis*, *leaves and tubers Allium cepa*, *Mentha piperita* leaves, leaves of *Murraya koenigii* and water extract of leaves of *Camellia sinensis* can inhibit *C. albicans* ²⁰.

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