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INHIBITORY EFFECT OF *Sansevieria trifasciata* L ON AERIAL PATHOGENIC MICROFUNGI IN TUTORIAL ROOMS

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ABSTRACT

***Background**: Air pollutants in a room can be caused by several things, such as microorganisms in the form of fungi. Fungi that dispersed in air with concentration>700 CFU/m^3 can be categorized as air pollution which could lead to many symptoms of various human diseases An effort that may improve indoor air pollution is using anti pollutant plant such as Sansevieria trifasciata L. This study aims to determine the effectiveness of Sansevieria trifasciata L on the concentration of aerial pathogenic microfungi in the tutorial room in Faculty of Medicine Swadaya Gunung Jati University and identify the aerial pathogenic microfungi species in the tutorial room.*
***Methods**: This study was a quasi experimental research with pre and post-test group design. Eight tutorial rooms with 4 repetitions were tested for species microfungi growth using Saburoud Dextrose Agar (SDA) media in 32 petri discs. After 7 days of incubation, microfungi were identified and the colony form unit (CFU) number was counted. The data was analyzed using paired T test.*
***Results**: Ten aerial pathogenic microfungi growth were significantly (p = 0.000) inhibited by Sansevieria trifasciata L demonstrated by CFU number reduction from 54.18 – 204.94 CFU/m^3 to 16.48 – 44.75 CFU/m^3.*
***Conclusions**: Sansevieria trifasciata L effectively inhibited aerial pathogenic microfungi growth in tutorial rooms.*

***Keywords**: Sansevieria trifasciata L, Aerial pathogenic microfungi, Air in the room.*

INTRODUCTION

World Health Organization (WHO) states that indoor air pollution is 1000 times more able to reach the lungs than outdoor air pollution [1]. Indoor air quality generally caused by several things, one of them is microorganism [2]. Microorganisms can be, mold, fungus, protozoa, viruses and bacteria. The presence of indoor microorganisms is influenced by temperature, humidity, lighting, occupancy density and ventilation system [3,4]. Poor indoor air quality can lead to a variety of health problems referred as, Sick Building Syndrome (SBS), a collection of symptoms caused by poor air quality of the room. These symptoms include colds, nasal congestion, sneezing, sore mouth cavity, dry mouth cavity, nausea, appetite loss, lethargy, fatigue, body aches and itchy skin [5,6].

One effort that can be done to improve the air quality of the room is the use of anti-pollutant plants. *Sansevieria* or better known as the Snake Plants or Lidah Mertua is an anti-pollutant plant. *Sansevieria* has the ability to absorb 107 types of toxins and airborne microbes [7,8]. Previous research stated that *sansevieria* stored in the room is effective in reducing formaldehyde, nitrogen and sulfur oxides, reducing the concentration of ozone in the indoor environment, and also an anti-microbial plant that has great potential that has not been exploited to improve air quality in room [9,10,11].

The aim of this research was to determine the effectiveness of *Sansevieria trifasciata* L on the concentration of aerial pathogenic microfungi in the tutorial roomss and identify the aerial pathogenic microfungi species in the tutorial room as well as analyzing the amount of aerial pathogenic microfungi concentration in the tutorial rooms with *Sansevieria trifasciata* L in Faculty of Medicine Swadaya Gunung Jati University.

METHODS

This research is *quasi experimental* design with *pre-post design group design.* The population of this research is the entire study room in Faculty of Medicine Swadaya Gunung Jati University. The sample of this research is 8 tutorial room (PBL) which is determined using *purposive sampling* method [12]. The sample size of this research is determined according to the formula Gomez *and* Gomez (1995) for experimental tests, that is: $(t)(r-1) \geq 20$.

Rooms included in the study met the criteria of inclusion: 1) room used for tutorial activities, 2) non-air conditioned room and 3) the room has a desk, chair, air conditioner and a blackboard. Rooms that had not been cleaned were excluded.

The research was conducted in December of 2017 until May 2018. Examination of isolation results was conducted in the microbiology laboratory Faculty of Medicine Swadaya Gunung Jati University. The independent variable in this research is *Sansevieria trifasciata* L. The dependent variable in this research is the concentration of aerial pathogenic microfungi.

Research procedure

The research was started by sterilization of tools, materials and media. All tools, materials and media used previously sterilized using *autoclave*, then dried using *oven*. For post-test treatment, we stored *Sansevieria trifasciata* L in pots with age 6 months, 6 leaf and height 80 cm in tutorial rooms in Faculty of Medicine Swadaya Gunung Jati University for 24 hours [13,14,15]. The making material consists of: 40 gr *Dextrose*, 10 gr *pepton*, 20 gr agar and 1000 cc aquades. All ingredients are mixed and heated until dissolved, then lifted, then sterilized in *autoclave.* SDA was added 250 mg of *chloramphenicol* to avoid contamination of bacteria. Sample isolation done in a predetermined room by opening media *Saburoud Dextrosa Agar* (SDA) and place them in 4 locations in one room diagonally for 15 minutes, then close it again. After that, *Saburoud Dextrose Agar* (SDA) media were stored for 7 days for the isolates to growth. Measurement of room temperature and humidity is done by placing digital *hygrometer* for 30 minutes, while sample identification was performed in macroscopic and microscopic examination. Macroscopic examination was done by observing the shape, characteristics and colors of the growing microfungi colonies in *Saburoud Dextrose Agar* (SDA) media, based on the book *Medically Important Fungi a Guide to Identification* [16] and books *Identification of Pathogenic Fungi* [17]. While in the microspic test, inspected material is placed on the glass object, the material is sprayed with 1-2 drops of solution LPCB (*Lactophenol Cotton Blue*), then covered with a glass of other objects. After that the preparation is left for 15-20 minutes. The shape and structure of the fungus is observed under a microscope, based on the book *Medically Important Fungi a Guide to Identification* [16] and books *Identification of Pathogenic Fungi* [17]. This research has been approved by the Research Ethics Committee Faculty of Medicine Swadaya Gunung Jati University with No.89/EC/FK/XI/2017.

RESULTS

The data shows the number of pathogen microfungi in each tutorial room Faculty of Medicine Swadaya Gunung Jati University. The first stage in conducting the test is to test the normality by using the test *Shapiro-Wilk* because of the data being tested <50. The results obtained are all groups data room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L which tested have p *Value* >0,05, these results show significant data distribution [18].

From the numerical comparative test with Paired T test [18], the results show the obtained p *Value* <0,05 then it can be said there are significant differences between room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L.

Table 1. Analysis of data distribution

	Mean	SD	Difference (SD)	CI95%	p Value
Effect Non-*Sansevieria*	26.42	14.19	19.50 (13.3)	14.71 –	<0.001
Effect *Sansevieria*	6.91	3.92		24.29	

*Result Paired T Test

Table 1 shows the results of statistical tests T Paired results obtained p *Value* 0,001. p *Value* obtained <0,05, this indicates that the number of aerial pathogenic microfungi in the room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L has a significant difference.

Isolation and Identification of Aerial Pathogenic Microfungi

Isolation aerial pathogenic microfungi in tutorial rooms Faculty of Medicine Swadaya Gunung Jati University done in 2 days (1st time) with vulnerable time 7.30 – 7.45 and isolation time of 15 minutes, because the vulnerable at that time humidity in the maximum state [19]. The condition of the room during the isolation of aerial pathogenic microfungi is sterile for 24 hours (holiday), with no use AC (*Air Conditioner*). Reasons not to use AC (*Air Conditioner*) at the time of isolation on the sample of the room, to see the state of the room naturally so the data obtained homogeneous.

After sampling, test samples were taken to the laboratory and then observed microfungi growth after being stored for 7 days [3,20].

Result isolation and identification of aerial pathogenic microfungi in tutorial rooms Faculty of Medicine Swadaya Gunung Jati University are as follows:

Table 2. Result isolation and identification of aerial pathogenic microfungi in the room before being given *Sansevieria trifasciata* L

No	Room Code	Temperature (%)	Humidity (°C)	Microfungi Species	Number of Colonies
1	I	67	25.4	*Aspergillus flavus*	4
				Mucor sp.	9
				Fusarium sp.	4
				Cladosporium sp.	1
				Penicillium sp.	1
				Syncephalastrum sp.	4
2	II	72	25.1	*Aspergillus flavus*	31
				Aspergillus niger	4
				Mucor sp.	9
				Aspergillus fumigatus	18
				Cladosporium sp.	22
				Syncephalastrum sp.	3
3	III	70	25.6	*Aspergillus flavus*	15
				Mucor sp.	13
				Aspergillus fumigatus	11
				Aspergillus versicolor	5
				Syncephalastrum sp.	4
4	IV	71	25.4	*Aspergillus flavus*	3
				Mucor sp.	16
				Cladosporium sp.	11
				Penicillium sp.	1
				Syncephalastrum sp.	6
5	V	61	28.5	*Aspergillus flavus*	10

No	Room Code	Temperature (%)	Humidity (°C)	Microfungi Species	Number of Colonies
				Aspergillus niger	8
				Mucor sp.	4
				Aspergillus fumigatus	3
				Cladosporium sp.	11
				Penicillium sp.	1
				Aspergillus versicolor	1
				Syncephalastrum sp.	12
6	VI	71	25.4	*Aspergillus flavus*	1
				Mucor sp.	7
				Fusarium sp.	1
				Cladosporium sp.	19
				Syncephalastrum sp.	6
7	VII	68	25.7	*Aspergillus flavus*	7
				Aspergillus niger	6
				Mucor sp.	16
				Aspergillus fumigatus	8
				Cladosporium sp.	2
				Penicillium sp.	3
				Syncephalastrum sp.	2
8	VIII	67	27.8	*Aspergillus flavus*	8
				Aspergillus niger	4
				Mucor sp.	5
				Cladosporium sp.	10
				Aspergillus versicolor	1
				Syncephalastrum sp.	8

Table 2 show room I with temperature 25,4°C and humidity 67% there were 23 colony with the most microfungi species *Mucor* sp. is the lowest number of colonies. While, room II with temperature 25,1°C and humidity 72% there were 87 colony with the most microfungi species *Aspergillus flavus* is the highest number of colonies.

Table 3. Result isolation and identification of aerial pathogenic microfungi in the room after being given Sansevieria trifasciata L

No	Room Code	Temperature (°C)	Humidity (%)	Microfungi Species	Number Of Colonies
1	I	27.3	61	*Aspergillus flavus*	5
				Mucor sp.	2
				Cladosporium sp.	2
				Alternaria sp.	1
				Syncephalastrum sp.	1
2	II	27.1	60	*Mucor* sp.	3
				Aspergillus fumigatus	2
				Cladosporium sp.	5
				Penicillium sp.	2
3	III	25.3	70	*Aspergillus flavus*	2
				Mucor sp.	5
				Aspergillus niger	9
				Cladosporium sp.	2
				Aspergillus versicolor	1
4	IV	26.5	66	*Cladosporium* sp.	3
				Syncephalastrum sp.	4
5	V	26.4	68	*Aspergillus flavus*	4
				Aspergillus niger	6

No	Room Code	Temperature (°C)	Humidity (%)	Microfungi Species	Number Of Colonies
				Cladosporium sp.	1
				Penicillium sp.	1
6	VI	26.2	68	*Mucor* sp.	7
				Cladosporium sp.	3
7	VII	25.9	68	*Aspergillus niger*	8
				Mucor sp.	3
				Aspergillus fumigatus	1
				Syncephalastrum sp.	1
8	VIII	25.8	68	*Aspergillus niger*	8
				Mucor sp.	1
				Cladosporium sp.	1

Table 3 show room III with temperature 25,3°C and humidity 70% there were 19 colony with the most microfungi species *Aspergillus niger* is the highest number of colonies. While, room IV with temperature 26,5°C and humidity 66% there were 7 colony with the most microfungi species *Syncephalastrum* sp. is the lowest number of colonies.

Aerial Pathogenic Microfungi

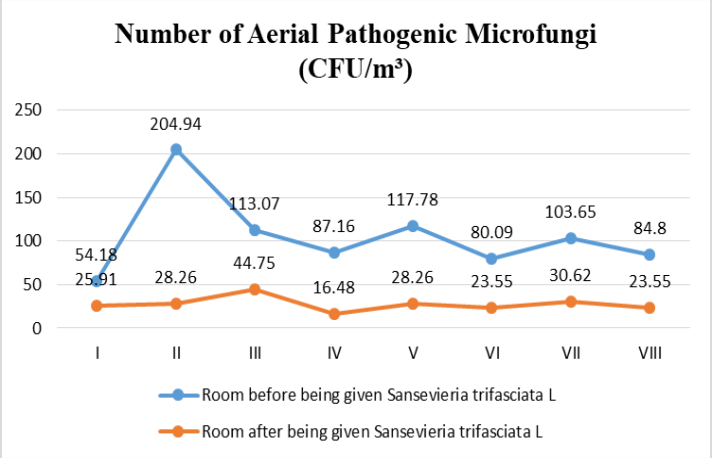

Figure 1. Calculation result of aerial pathogenic microfungi in Tutorial rooms

DISCUSSION

Aerial pathogenic microfungi in the room before and after given Sansevieria trifasciata L.

Figure 1 shows that there are differences in the number of aerial pathogenic microfungi colonies between room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L. This can be *Sansevieria trifasciata* L in the process of photosynthesis, using their stomata to absorb pollutants and microfungi. other than that, every leaf *Sansevieria trifasciata* L contain active substances *pregnane glikoside* which can decompose toxic substances such as *carbondioksida*, *benzene* and *formaldehyde* into amino acids that are no longer harmful to humans [7,9].

Differences in the number of colonies aerial pathogenic microfungi between room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L is also in accordance with previous research which states that *Sansevieria trifasciata* L can improve air quality indoors which is caused by the active substance *pregnane glikoside* contained in the leaves *Sansevieria trifasciata* L which can reduce the pollutant and detoxification process in microfungi [7,10,11].

Other than that, differences in the number of microfungi in this research also affected by the presence of factors that can increase the number of microfungi in the room. These factors consist of: temperature, oxygen, humidity, pH and nutrients. Previous research state that the number of microfungi in each room is different that can be caused because the temperature and humidity in the room is different [3,21,22].

Table 2 shom room II and Table 3 show room III has a high number of microfungi with high room humidity. This can be caused because of air circulation low that cause air temperature increases so it can speed up the evaporation of water somewhere. High humidity and low temperatures will cause breeding of *allergen* pathogenic microfungi thus affecting the number of microfungi indoor. Then, because the microfungi habitat is in a humid place. Previous research by Geller dkk, state that the number of aerial microfungi can also be affected by presence AC *(Air Conditioner)* which will affect the growth of biological agents, such as fungi and bacteria which will release a microtoxin compound which can attack the respiratory system causing infection, allergies and toxicity [23,24].

The highest number of aerial microfungi in the room II which is room before being given *Sansevieria trifasciata* L and room III which is room after being given *Sansevieria trifasciata* L can also be caused by spores carried by students from outdoors which can be attached to the shirt then scattered on the crevices of the wall and roof thereby causing the growth of microfungi to expand widely. While the lowest number of aerial microfungi visible on the room I which is room before being given *Sansevieria trifasciata* L and room IV which is room after being given *Sansevieria trifasciata* L. The room including into the room that has quality of air ventilation, temperature room, and humidity room which is standardized based on Regulation of the Minister of Health of the Republic of Indonesia.

This research shows the number of aerial pathogenic microfungi in tutorial rooms Faculty of Medicine Swadaya Gunung Jati University between room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L still can be said normal based on Regulation of the Minister of Health of the Republic of Indonesia, however still need to be prevented for the amount of aerial pathogenic microfungi can be minimized its existence. How it can be done to minimize number of aerial pathogenic microfungi is with controlling for factors which can increase its growth, with control room temperature ranged between 18-30^{o}C and humidity room ranged 40-60% and save plant *indoor pollutan* in the room [10,25].

Sansevieria trifasciata L *decreased the number of aerial pathogenic microfungi*

This research done by save the plant *Sansevieria trifasciata* L as many as 6 leaf for 24 hours in tutorial room, because based on research from Wolfereton Environmental Service, ability of each leaf *sansevieria* can absorb 0,0938 microgram/hours *indoor pollutan*. When synchronized with the room 75 m^2 simply put *sansevieria* with 4 leaf. Then, do sampling and temperature measurement, humidity and calculation of the number of microfungi colonies in tutorial room. *Sansevieria trifasciata* L is one factor which may affect number of aerial pathogenic microfungi in the room.

Research result in Figure 1 show that a given room *Sansevieria trifasciata* L for 24 hours can affect number of aerial pathogenic microfungi in the room. This corresponds to research by Weyens, state that in microbial plants one of which is *Sansevieria trifasciata* L there is great potential that has not been exploited to improve indoor air quality and outdoor air quality [9].

Sansevieria trifasciata L is one of the plants *indoor pollutan* because it has the ability to reduce indoor pollution and outdoor pollutin. *Sansevieria trifasciata* L has thick fleshy leaves which is capable of storing lots of water content so tolerant of water shortages and dry air [26]. Every leaf *Sansevieria trifasciata* L contain active substances *pregnane glikoside* which can reduce the pollutant to harmless compounds. other than that, stomata that are in its leaves used for photosynthesis process [7].

In the process of photosynthesis stomata is the entry of *carbondioxide* from the air, where the road respiration and able to absorb toxic substances or spora which then will enter the metabolic system in the plant body and will be sent to the root to be detoxified by microbes. Through the process microbes will produce a substance which is needed by plants and produce gas which is beneficial to humans

namely in the form of *oxygen* [27]. Therefore, plant *indoor pollutan* doing symbiosis with microbes which is known as the fitroremediation process because of the stem, leaves and plant roots covered by microbes [9].

CONCLUSIONS

Sansevieria trifasciata L effectively inhibits growth of 10 aerial pathogenic microfungi in the tutorial rooms: *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus versicolor*, *Mucor* sp., *Penicillium* sp., *Syncephalastrum* sp., *Fusarium* sp., *Cladosporium* sp.and *Alternaria* sp. There are different numbers of aerial pathogenic microfungi between room before being given *Sansevieria trifasciata* L and room after being given *Sansevieria trifasciata* L with mean of 54.18 – 204.94 CFU/m^3 dan 16.48 – 44.75 CFU/m^3, with statistical analysis there are significant differences (p *Value* = 0.001).

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