THE POTENTIAL OF PURPLE LEAVES ETHANOL EXTRACT (Graptophyllum

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Submission date: 14-Apr-2023 10:35PM (UTC-0700)
Submission ID: 2065108007
File name: 30._Jur._Juatika_2021.docx (125.1K)
Word count: 5998
Character count: 32401

JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL.

eissn 2656-1727
pissn 2684-785X
Hal :

THE POTENTIAL OF PURPLE LEAVES ETHANOL EXTRACT (*Graptophyllum pictum L.*) AGAINST THE GROWTH OF *Staphylococcus aureus* and *Candida albicans*

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ABSTRACT

The Potential of Purple Leaves Ethanol Extract (*Graptophyllum pictum* L.) against Staphylococcus aureus and Candida albicans. This study is an experimental study with a comparative approach, aimed at analyzing the potential of purple leaves (*Graptophyllum pictum* L.) by using in vitro method against Staphylococcus aureus and Candida albicans. The clear zone was formed between the outer sides of the paper disc containing the ethanolic extract of the purple leaves (*Graptophyllum pictum* L.) and the *S. column. gold* and *C. albicans* colonies are growth indicators. The growth of *S. aureus* and *C. albicans* were measured at incubationtime 24, 48, and 72 hours, which were then analyzed by analysis with Anava's one-way statistical test and continued with Duncan's 1%. The research found that the purple leaves ethanol extract (*Graptophyllum pictum* L.) has the growth inhibition of *Staphylococcus aureus* and Candida albicans, which is indicated by the comparison results of the optimal concentrationsof *S. aureus* and *C. albicans*, were 50% and 90%, so that the purple leaf ethanol extract could recommended as an antibacterial.

Keyword: Candida albicans, purple leaves (*Graptophyllum pictum* L)., *Staphylococcus aureus*

INTRODUCTION

Microbes are closely related to everyday life. Microorganisms have the main characteristic that distinguishes them from one another, namely the organization of their cellular material (Waluyo, 2016). Microorganisms consistof bacteria, viruses, yeasts, molds, and protozoa, of all these types of microorganisms, one of which can be beneficial and can be harmful. Beneficial microorganisms are a group of normal flora, while harmful microorganisms have a tendency to cause various diseases or are called pathogenic microbes. Pathogenic microorganisms that cause infection in humans, one of which is Staphylococcus aureus and Candida albicans (Anggraini et al., 2019). *S. aureus* is a normal flora found on human skin and human mucous membranes (Triana, 2014), while *C. albicans* is a fungal flora commonly found in the oral cavity, respiratory tract, digestive tract and vagina. *S. aureus C. albicans* which can trigger pathogenic which in excess can cause inflammation or abscess and cause infection, as well as infections. Control of infections caused by microbes is generally with the use of antibiotics. Inappropriate use of antibiotics causes resistance. (Retnaningsih et al., 2019) said that one way to minimize the

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potential for antibiotic resistance to emerge is to use medicinal plants (back to nature). More than 30,000 plant species in Indonesia's forest areas areplants that have the potential as medicine (Fuadi, 2019). However, most people do not know the types of medicinal plants, sothey are considered more as wild plants (Yuda et al., 2019). Plant species tend to be considered as wild plants, but have potential as medicinal plants, namely Purple Leaves (Graptophyllum pictum L.). Purple leaf plants are considered a group of shrubs, and are only considered as wild plants, so they tend to be ignored. The results of the study (Retnaningsih et al., 2019) showed that Purple leaves were effective against various infections, due to secondary metabolites containedin Purple leaves. The chemical components contained in purple leavesare alkaloids, nontoxic, flavonoids,glycosides, steroids, phenols, polyphenols, saponins, and tannins. The potential of purple leaves has not been widely known by the public, due to the lack of scientific documentation of the potential of purple leaves. The lack of information and public knowledge about the benefits of purple leaves in a sustainable manner indicates the need for literature on the benefits of purple leaves. Purple leaves extract was declared effective as an antibacterial of S. aureus. The final findings of this study are expected to be the scientifically documented potential of purple leaf ethanol extract as an antibacterial.

MATERIALS AND METHODS

This research is a comparative laboratory experimental study, with the aim at knowing the comparison of the potential of the purple leaf ethanol extract against S. aureus and C. albicans. The results measurement was carried out after the research treatment. The study was conducted at the Microbiology Laboratory of the State Islamic Institute of Palangka Raya, Central Kalimantan. The indicator of microbial growth inhibition was measured based on the growth inhibition zone which was marked by a clear zone formed between S. aureus colonies on Nutrient Agar (NA) plate medium and C. albicans colonies on Sabouraud Dextrose Agar (SDA) plate medium with the outer side of the paper disc containing Purple leaf ethanol extract. Observations on the growth of S. aureus and C. albicans were carried out at incubation periods of 24, 48, and 72 hours after treatment.

Purple Leaf Extract Preparation

The stages in the preparation of the purple leaf extract begin with preparingthe leaves to be used, which have been washed clean, then roughly cut to a size of ± 2 cm. The cut leaves are dried by sun tanning them. After the leaves dry, the next step is to blend the leaves until they have a smooth texture. The samples weredried in a blender until they became simplicia. Simplicia was immersed in ethanol for 3 days at room temperature.

The next step is a mechanical filtering process using a cloth, by squeezing the cloth. Filtering was carried out 3 times, namely 2 times filtering using cloth, and 1 time filtering using filter paper placed on a separating funnel.

Purple Leaf Extract Maceration

Extraction by maceration method of Purple Maserate leaves is then filtered,the filtrate is separated and the dregs are soaked back into new ethanol, the maceration is repeated ±3 times until clear maserate is obtained. The obtained filtrate is concentrated in a rotary evaporator (40oC) or at a boiling temperature, until a thick extract or paste is obtained. The paste was then put into a vial and dried in a desiccator to obtain a dry extract.

The next step is to dilute the extract. Extract dilution was carried out with reference to the research design that had been previously designed, which included several concentrations of 40% (3.8 g of Purple leaf extract + 5.7 ml of sterile distilled water), 50% (4.75gr + 3.8 ml), 60 % (5.7 gr+2.85 ml), 70% (6.65gr+2.9 ml),

80% (7.6 gr+0.951 ml), 90% (8.55 gr+0.951 ml). The diluted extract will be used in the analysis of the potential of Purple leaves against S. aureus and C. albicans. The extract obtained was stored in a vial bottle at a refrigerator temperature.

Microbial Culture

Bacterial cultures of S. aureus and C. albicans were obtained from the Microbiology Laboratory of the Biology-MIPA Tadris Study Program, IAIN Palangka Raya. The cultures were inoculated in liquid medium and then incubated at 37oC for 18-24 hours. Then standardized with the Mc Farland standard, with the aim that it is equivalent to 108 CFU/ml by adding 0.85% NaCl.

Culture Stock Preparation

The stage of preparation of the parent stock of microbial culture begins with preparing nutrient both medium and inoculating microbial colonies from culture into the medium as much as 1 ose aseptically (Waluyo, 2016). Medium Nutrient both that had been inoculated with S. aureus and C. albicans colonies were incubated for 48 hours at 37°C. The incubation procedure aims at optimizing microbial growth (Aulia et al., 2011).

Potential Analysis of Purple Leaf (*Graptophyllum pictum* L.) Against Staphylococcus aureus and Candida albicans

Antimicrobial analysis of S. aureus and C. albicans was previously carried out by culturing S. aureus and C. albicans in liquid medium and incubating for 24hours. The treatment phase of the study was carried out by preparing nutrient agar(NA) and Sabouraud Dextrose Agar (SDA) plates as medium.

Both types of medium were dissolved in aquadest, and homogenized on a hot plate stirrer. Then 15 ml of the medium was put in a petri dish and wet sterilized using an autoclave at 121°C with apressure of 15 lbs for 15 minutes (Anggraini et al., 2019). The prepared medium was then used for the cultivation of S. aureus and C. albicans microbes. Liquid cultures of S. aureus and C. albicans that have been incubated are gently shaken for 3 minutes, with the aim at spreading the microbial coloniesevenly. Liquid cultures of S. aureus and C. albicans are planted as much as 0.5 ml in each medium evenly. Furthermore, the prepared paper discs were immersed at each concentration according to the research treatment, namely 40%, 50%, 60%, 70%, 80%, 90%. Soaking is done for 1 minute. The entire paper disc thathas been soaked in Purple leaf extract is then placed in the middle of the surface ofthe NA & SDA plate aseptically using the disc method. The treated medium was incubated at 37°C. Data were collected at incubation periods of 24, 48, and 72 hours.

Growth Inhibition Zone Measurement

The results were read after being incubated for 24 hours at 37oC by measuring the zone of inhibition, namely the clear area around the discs where there was no bacterial colony growth. Measurement of S.aureus growth was based on the measurement of the diameter of the clear zone between the extract and the outer side of the clear zone, where the clear zone was a parameter of growth inhibition.

RESULTS AND DISCUSSION

The research data included the growth inhibition zone of S. aureus and C. albicans. Data were collected when the cultures of S. aureus and C. albicans were 24, 48, and 72 hours old at a temperature that had been set at 37ºC.

Data analysis

Observation data was carried out after the treatment, namely at the incubation period of 24, 48, and 72 hours. The analysis of the observational data was then carried out by analyzing the one-way Anova statistical test and continued with the Duncan 1% test.

Treatment Data of Purple Leaf Ethanol Extract (Graptophyllum pictum L.) against Staphylococcus aureus

The data from the inhibition zone for the growth of S. aureus bacteria on Nutrient Agar (NA) basic medium are

presented in Table 1.

Table 1 Growth Inhibition Zone of Staphylococcus aureus on NA Medium

Treatment		Average Inhibition Zone (mm)					
		24 Hours		48 Hours		72 Hours	
Chloramfenicol 0.1% (+)		3.52	b	3.59	b	4.04	b
Aquades (-)		0.00	a	0.00	a	0.00	a
Concentration	40%	4.04	b	4.37	bc	6.18	bcd
	50%	6.24	c	7.64	d	9.02	d
	60%	8.64	c	8.15	d	8.49	d
	70%	3.54	b	4.47	bc	4.76	bc
	80%	3.14	b	5.27	bcd	5.61	bcd
	90%	8.24	c	6.94	cd	7.19	cd

Notes:
Different notations in the same column show a significant difference based on the 1% DMRT test

The recapitulation data in Table 1 above has a varied mean zone of inhibition, where Chloramphenicol 0.1% as the positive control of the study had a lower mean zone of inhibition compared to the zone mean of the purple leaf ethanol extract. The use of Chloramphenicol as a positive control research with consideration of its potential to be bacteriostatic or inhibit bacterial growth, is equivalent to the potential of Purple leaf extract which is known to contain many potential compounds as bacteriostatic. This chemical mechanism will result in a certain synergistic effect after treatment, because compounds that are bactericidal if combined with bacteriostatic compounds, the bacteriostatic effect will stop the growth of bacterial cells. Chloramphenicol is one of a group of antibiotics that can inhibit microbial cell protein synthesis.

The mechanism of growth inhibition was observed at 24 hours of observation, 3.52 mm (Chloramfenicol 0.1%). Meanwhile, the mean zone of purple leaf extract at 24 hours of observation was 6.24 mm. This shows that the inhibitory power of the extract on the growth of S. aureus at a certain concentration is stronger than the positive control of the study. At a certain concentration, the antibacterial power of Purple leaf extract is stronger in inhibiting the synthesis of peptidoglycan in bacterial cell walls, compared to 0.1% Chloramphenicol,where it is known that these components are important components to maintain the integrity of bacterial cell walls, while humans do not need peptidoglycan to maintain cell wall integrity. .

However, in a higher concentration, Chloramphenicol is one type of antibiotic that has a broad spectrum of activity, namely an antibiotic that can kill various kinds of bacteria including normal flora bacteria, so that 0.1% Chloramphenicol is quite representative used as a comparison in this study. .

The observed data in Table 1 is confirmed by Duncan's test results of 1% at 24-hour observation, namely thesmallest concentration which has almost the same inhibitory power as the higher concentration is 50% concentration, so that 50% concentration is interpreted as the effective concentration of the study. The 48-hour observation above showed that the treatment of purple leaf ethanol extract (Graptophyllum pictum L.) had a significant effect on S. aureus. This is evidenced by the results of the average inhibition zone Chloramphenicol is 3.59 mm, while the extract is 7.64 mm. The treatment in the form of administration of purple leaf ethanol extract had almost the same effect as 24-hour observation, namely the 50% concentration was not significantly different from the 90% concentration, so the effective

concentration, namely the 50% concentration, was interpreted as the effective concentration in inhibiting the growth of S. aureus. This is because Purple leaf extract contains alkaloids that function as antibacterial. This statement is in line with research (Suryaku, 2017) which states that alkaloids have the ability as antibacterial by denaturing proteins and damaging cell membranes.

Damage to cell membranes results in changes in cell permeability, resulting in growth inhibition. The process of growth inhibition due to the content of secondary metabolites is characterized by the formation of an inhibition zone betweenthe paper disc and microbial colonies. This inhibited cell growth, in a long time will cause cell death. This can be seen during the 24 hour incubation period, which is interpreted as the antimicrobial content in the paper disc is directlyproportional to the greater the mean zone of microbial growth inhibition.

Flavonoids in secondary metabolites of plants also function as antibacterial, namely forming complex compounds with extracellular and dissolved proteins so that they can damage bacterial cell membranes followed by the release of intracellular compounds. Intracellular compounds that are pulled out of the cell result in the rupture of the membrane or plasma membrane, which in a certain incubation time results in cell death (Hujjatusnaini et al., 2021).

In vitro cell death is defined as a process of necrosis, where cell or tissue death occurs as a result of an irreversible degeneration process, while the process between degeneration and cell death is also called necrobiosis. The occurrenceof necrosis is estimated to be observed about 6 to 8 hours after cell death. Macroscopically, the cells or tissues that undergo necrosis are characterized by paleness, followed by the condition of the tissues becoming softer and there appears to be a demarcation (limiting) with healthy tissue. This cell or tissue barrier is used as a cell death zone.
Usually around cells or tissues that undergo necrosis are always accompanied by inflammatory cells, because dead cells are strange objects to the body.

Observations continued at 72 hours incubation period showed a verysignificant decrease in inhibition at 72 hours incubation period, the notation showed higher concentrations (90%)which did not differ statistically with lower concentrations (60%). The data illustrates that the 50% concentration still has the same ability with the incubation period of
24 hours and 48 hours. It can be interpreted that the concentration of 50% is an effective concentration in inhibiting the growth of S. aureus bacteria.

(Hujjatusnaini et al., 2021) explained that the growth of S. aureus was almost the same as the growth of other normal flora. because basically S. aureus is a bacterium that includes normal flora, especially on the skin and mucous membranes in humans. S. aureus has an optimum temperature at 35oC, where the limit of growth temperature is between 15oC and 40oC. Another tendency is that these bacteria prefer aerobic conditions, and these conditions are very good for the growth of S. aureus bacteria. S. aureus can grow in air containing only hydrogen and Optimum pH 7.4 for growth. S. aureus is a facultative anaerobe. Young S. aureus colonies were colorless, but their growth was formed by pigments that were soluble in alcohol, ether, chloroform, and benzoyl.

S. aureus is a normal flora found on the skin, respiratory tract and digestive tract of food in humans. S. aureus has invasive properties, can cause hemolysis, form coagulation, liquefy gelatin, and ferment mannitol. S. aureus can cause disease because it has the ability to multiply and spread widely in tissues and through the formation of extracellular substances. As long as S. aureus continues to increase in the tissue, leukocytes will also increase to kill these bacteria.

Based on the data above, it can beseen that the 50% concentration of the

purple leaf ethanol extract was effective and able to inhibit the growth of S. aureus. This is because purple leaves contain secondary metabolites that function as antibacterial. This is because Purple leaves have secondary metabolites in the form of flavonoids and alkaloids. In line with research (Aulia et al., 2011) which says that Purple leaves can be used as antibacterial.

Purple leaf ethanol extract contains secondary metabolites in the form of flavonoids and alkaloids that have benefits as an inhibitor ofmicroorganisms, one of which is S. aureus bacteria. Research results from (Retnaningsih et al., 2019) confirm that Purple leaves contain secondary metabolites such as alkaloids, flavonoids, saponins, steroids and tannins. The results of this study confirmed that one of the ingredients possessed by Purple leaves such as flavonoids and alkaloids was proven to be antibacterial. Flavonoids are included in phenolic compounds found in nature which have many properties, one of which is antioxidant and antibacterial, so the findings of this study are in line with previous studies where Purple leaf extract was proven to have an inhibitory effect on the growth of S. aureus.

In addition to flavonoids, the active metabolite of alkaloids contained in Purple leaves is known to work as an antibacterial. The mechanism of action of alkaloid compounds is by interfering with the peptidoglycan constituent components in bacterial cells. Disruption of the peptidoglycan constituent of bacterial cells causes the cell wall layer to be damaged, resulting in cell death or necrosis.

Peptidoglycan is the main component of the bacterial cell wall, which is rigid. Because of its rigid composition, peptidoglycan functions as a part that is responsible for maintaining cell integrity, as well as being a determinant of cell shape. Peptidoglycan is only found in certain bacterial species, one of which is S. aureus. However, the structure of peptidoglycan found in Gram negative bacteria is different from that of Gram positive bacteria. In general, this peptidoglycan (murein) is a polysaccharide consisting of two derived sugars, namely N-acetylglucosamine acid and N-acetyl muramic acid linked by -1,4 bonds, and a short peptide chain. Therefore, peptidoglycan has a direct involvement in the process of cell death.

Another potential antimicrobial activity is tannin which is predicted to cause a decrease in bacterial cell permeability and turgosity, so that the cell wall shrinks. The decrease in cell turgidity will disrupt the permeability of the cell itself and cause cell wall damage. Cell membrane permeability is the ability of the cell membrane to transport needed substances from the outside or the extracellular environment into the cell or cytosol (Hujjatusnaini et al., 2021).

Purple Leaf contains alkaloids, flavonoids, and tannins in dominant quantities, thus strengthening its potential as an antibacterial in the dominant composition. The mechanism of action of the disruption of cell wall permeability generally involves the role of terpenoid metabolites, because terpenoids also act as antibacterials. Terpenoids are thought to be involved in membrane damage of lipophilic compounds. Terpenoids are reactive to transmembrane proteins or porins in the extracellular membrane of bacterial cells. This interaction forms a strong polymeric bond, resulting in damage to the porin which ultimately results in a decrease in the permeability of the bacterial cell wall. If cell permeability is disturbed, the nutrients needed for bacterial cell growth are also disrupted. At a certain incubation period, bacterial cells will experience growth inhibition, marked by the formation of an inhibition zone in vitro. The mean of growth inhibition zone of S. aureus is presented in Figure 1.

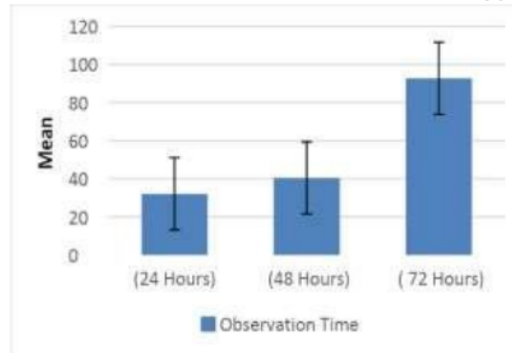

Figure 1. Mean of growth inhibition zone of Staphylococcus aureus

The mean value in Figure 1 illustrates that 72 hours of incubation has a greater effect on optimizing the effect than 24 hours and 48 hours, so the results can be used as indicators for determining the most effective concentration in the formulation. Observation of the growth inhibition zone of S. aureus was confirmed by the comparison of Duncan test results presented in Table 1.

Data on Treatment of Purple Leaf Ethanol Extract (Graptophyllum pictum L.) against Candida albicans

The data from the observation of the inhibition zone for the growth of C. albicans bacteria on SDA medium are presented in Table 2. The measurementof the growth of C. albicans is based on the results of the measurement of the diameter of the clear zone between the extract and the outer side of the clear zone, where the clear zone is aparameter of growth inhibition.

C. albicans is a dimorphic fungus because it has the ability to grow in two different forms, namely as shoot cells which will develop into blastospores and produce sprouts which will form pseudohyphae. The difference in thisform depends on the external factors that influence it (Maulidah, 2019)

C. albicans is often found as a cause of infectious diseases of the female genitalia and perigenital area. C. albicans is a normal flora group of fungi that live in the human body such as in the mouth, throat, vagina and digestive system. C. albicans in the human body are saprophytic and pathogenic (Itsa et al., 2018).

C. albicans is microscopically round, oval, with a smooth surface, smooth or folded, yellowish white in color and has a yeast odor and has a complex cell wall structure, 100 to 400 nm thick. C. albicans can grow at a pH of 4.5-6.5 and at a temperature of 28◦ C-37◦C (Nuryati & Huwaina, 2015). The disease caused by C. albicans is called candidiasis. Candidiasis is an acute and sub-acute fungal disease caused by Candida sp species, usually C. albicans (Farizal & Abdul Rahman Serbasa Dewa, 2017). This microorganism is one of the most potent groups of yeasts and is closely related to infections of the reproductive system. These microorganisms are saprophytic, so that under conditions of pH and humidity suitable for growth, they tend to be pathogenic and cause inflammation and infection.

Pathogenicity is the ability of microbes that are pathogenic, or cause infection or inflammation related to their ability to produce enzymes or toxins. This pathogenicity will increase along with the

decreasing fungistatic or functional properties.

Table 2.Growth Inhibition Zone of Candida albicans on SDA Medium

Treatment		Inhibition Zone Mean (mm)					
		24 hours		48 hours		72 hours	
Albothyl 0.25% (+)		8.44	b	8.81	b	26.44	d
Aquades (-)		0.00	a	0.00	a	0.00	a
concentration	40%	13.74	c	14.79	c	15.14	bcd
	50%	5.13	b	7.88	b	11.34	bc
	60%	7.89	b	8.02	b	8.64	b
	70%	14.14	c	14.69	c	16.22	bcd
	80%	17.14	c	17.74	c	19.14	cd
	90%	12.14	c	14.94	c	16.04	bcd

Notes:
Different notations in the same column show a significant difference based on the 1% DMRT test.

The recapitulation data in Table 2 has an average inhibition zone of 0.25% Albothyl as a positive control study has a lower mean zone of inhibition compared to the zone average of the purple leaf ethanol extract. (Mutiara Sandy & Burhanisa Irawan, 2019) describes Albothyl as an antiseptic and disinfectant for mucosal tissue infections containing policresulen compounds. Albothyl 0.25% was used as a positive control study with consideration of its role against infections caused by fungal and bacterial groups, where the condensation process of meta cresol sulfonic acid and methanol. Furthermore, it is known that policresulen is usually used to stop local bleeding or local hemostatic, because policresulen is a condensation product compound metacresol sulphonic acid and methane. The mechanism of action of these compounds will eventually cause the infected cells to die.

At the observation time of 24 hours, 8.44 mm (Albothyl 0.25%) Meanwhile, the mean zone of purple leaf extract at the observation time of 24 hours was 13.74 mm. This shows that the inhibitory power of the extract on the growth of C. albicans is stronger than the positive control of the study. The data were also confirmed with the Duncan test results 1% at 24 hours observation, it can be interpreted that the effective treatment level of purple leaf ethanol extract at 24 hours observation time is 40% concentration. The results of the observation of the effective and optimum concentration of purple leaf extract during an incubation period of 24 hours are in line with the statement (Maya Ayuningtias, 2017) that the ethanolic extract of purple leaf has antifungal activity against C. albicans.

Observations at the 48-hour incubation period showed that the effective treatment level of the purple leaf ethanol extract at the 48-hour observation time was a concentration of 40%. The effective concentration at 48 hours of observation is not different from 24 hours, so it can be interpreted that the 40% concentration still has the same inhibitory power up to48 hours.

This inhibitory power is influenced by the flavonoid content contained in the ethanol extract of purple leaves which can function as antifungal (Sari, 2017). The effectiveness of secondary metabolites in ethanol extract as antifungals was then observed for 72 hours, at 72 hours showed that Albothyl 0.25% had the largest inhibition zone. These data indicate that the effectiveness ofsecondary metabolites contained in the ethanolic extract of Purple leaves is only able to last up to 48 hours, while at 72 hours it has an inhibitory power that is not better than the antifungal at Albothyl 0.25%. The decrease in inhibition at 48
hours and decreased at 72 hours

incubation was influenced by the weaker fungicidal properties in the extract. Its fungistatic properties are decreasing and can even disappear altogether.

The results of statistical analysis showed that the purple leaf ethanol extract had a significant effect on the Sig value. 0.000 < 0.01, both at incubationtime of 24 hours, 48 hours, and 72 hours. However, when viewed from the comparison of the mean values (Figure2), the incubation period of 72 hours hasa higher mean value than other incubation times.

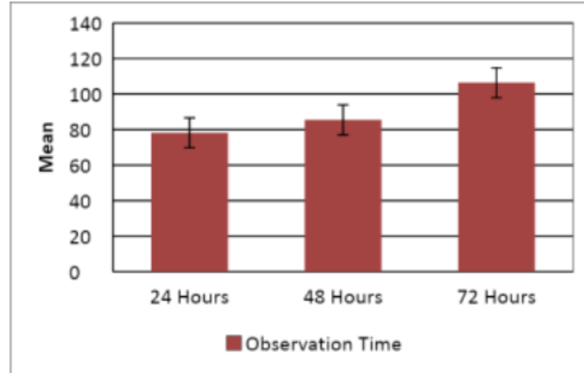

Figure 2. Mean of Growth Inhibition Zone of *Candida albicans*

The comparison of the mean value in Figure 2, where the comparison of the mean gives the fact that the incubation period of 72 hours has a much greater difference in effect than 24 hours and 48 hours, so the results can be used as an indicator for determining the most effective concentration. To determine the potential tendency of purple leaf as an antimicrobial, it can be seen from the comparison of the inhibitory power of purple leaf against S. aureus and C. albicans as presented in Figure 3.

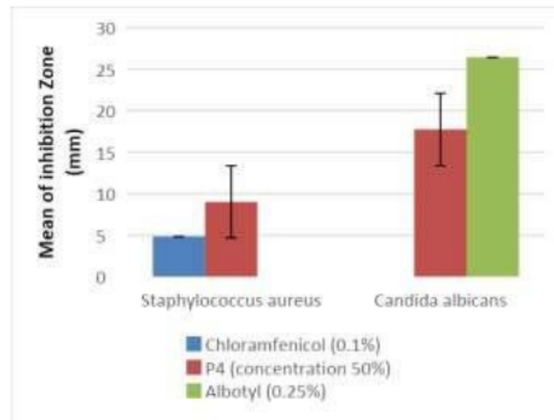

Figure 3 Comparison of formed inhibitory power from *Staphylococcus aureus* and *Candida albicans*

Figure 3 above provides an illustration of the comparison of inhibition formed by S. aureus and C. albicans. The inhibitory

power formed from S. aureus was 4.84 mm (Chloramfenicol 0.1%), for a 50% concentration of 9.02 mm. Meanwhile, the

inhibition zone formed from C. albicans, 26.44 mm (Albothyl 0.25%), for a 50% concentration of 17.74 mm. If seen from the comparison of the image above, it can be interpreted that the ethanolic extract of purple leaf has a greater potential as an antifungal. This is based on the inhibition zone formed, which is 17.74 mm. In line with the statement (Sari, 2017) that the ethanol extract of Purple leaves has an antifungal effect on the growth of C. albicans. The ethanolic extract of purple leaves can inhibit the growth of C. albicans or has the potential as an antifungal because it contains secondary metabolites in the form of saponins. In line with research (Sari, 2017) that saponins have antifungal or antifungal effects. Saponins work by damaging the cytoplasmic membrane, so that it can inhibit the growth of C. albicans.

Cytoplasm is an intracellular fluid found between the plasma membrane and the nucleus, where chemically it is known that about 70-90% of the cytoplasm consists of water and solid components (proteins, carbohydrates, lipids, and inorganic substances). The cytoplasmic membrane is the membrane that surrounds the cytoplasm. Thismembrane is composed of a layer of phospholipids and proteins. This cytoplasmic membrane is a membrane that functions to enclose the cytoplasmand its contents, located just below the cell wall but not tightly bound to the cell wall. Structurally, it is understood that this membrane is very important for cells, because it acts as a separator between the inside of the cell and the environment. In connection with the mechanism of action of saponins in destroying the cytoplasmic membrane, it is closely related to the destruction of the permeability and selectivity of the membrane, so that the ability of the membrane to maintain cell osmotic pressure is disrupted.

Saponins are antifungal compounds that have an energy mechanism that can interfere with electron transfer. This electron transfer that occurs will disrupt the stability of phosphorylation in the mitochondria, as a result, energy metabolism in the mitochondria is disrupted. This cellular condition will cause oxygen intake to decrease in mitochondria, so that the function of the tricarboxylic acid cycle was disrupted. The antifungal mechanism of the content of secondary metabolites in Purple leaves results in disruption of the formation of Adenosine Triphosphate (ATP) and Adenosine Diphosphate (ADP).

The inhibition zone formed can also be interpreted as the occurrence of protein denaturation of microbial cells. Denaturation of cell proteins causes shrinkage of cell walls, which in the longer term will result in necrosis. The content of metabolites that act as antifungals will generally diffuse to the fungal cell membrane, which then interferes with cellular metabolic pathways (Maya Ayuningtias, 2017).

Another antifungal mechanism according to (Hujjatusnaini et al., 2021) is an antifungal mechanism that suppresses the growth of fungal hyphae and mycelium, thereby inhibiting fungalgrowth. Flavonoid compounds enter into fungal cells through holes in the cell membrane that are formed because phenolic compounds have denatured cell membrane lipids. These protein compounds will be denatured by flavonoids through hydrogen bonds. The ability of flavonoids to bind to proteins causes inhibition of cell wall formation, so that hyphae growth is also inhibited because the required cell wallcomposition is not fulfilled.

In addition, other mechanisms were also described, including the involvement of cytochrome P450 enzymes needed to maintain the integrity of fungal cell membranes. Cytochrome P450 (CYP) is a group of enzymes or isoenzymes that are known to have a very important role in metabolic processes, namely helping to change the content or efficacy of drugs in an ingredient into active metabolites. The antifungal metabolism is able to reducethe surface tension of the sterol

membrane of the cell wall of C. albicans, resulting in an increase in its permeability. This sterol membrane is a membrane that contains sterol fat, namely ergosterolwhich is only found in the group of fungi, whose function is the same as cholesterol in animals. The increase in permeability causes the intracellular fluid to become more concentrated and is drawn out ofthe cells, resulting in swelling of the cells, and within a certain incubation time causes fungal cell death.

Fungal cell walls contain mannoproteins, chitin and alpha, andbeta-glucans which play an important role in protection, maintaining cell morphology and cell rigidity, metabolism, ionexchange and filtration, antigenic expression. The antifungal metabolite compounds in purple leaves will inhibit the synthesis of -glucan fungal cell walls, some of which are a group of fungi including Candida albicans and Candida glabrata (Apsari & Adiguna, 2013).

Several other antifungal compounds are known to interfere with energy metabolism in mitochondria, namely in the process of electron transfer and phosphorylation. These antifungals interfere with the chemical process of electron transfer, which begins with inhibition of energy metabolism in the mitochondria. The inhibition of electron transfer reduces oxygen and interferes with the functioning of the tricarboxylic acid cycle. If electron transfer is inhibited, further chemical processes will not occur. With the inhibition of electron transfer, the phosphorylation step will not occur. As a result, the formation of adenosine triphosphate (ATP) and adenosine diphosphate (ADP) is also inhibited.

The antifungal mechanism of action includes phenol groups which will form complexes with proteins in the cell membrane, resulting in clumping. The clumped proteins are denatured. This denaturation is characterized by the process of breaking hydrogen bonds, hydrophobic interactions, salt bonds and the formation of molecular folds, protein denaturation, resulting in decreased cell membrane permeability, disrupted nutrient transport in cells, and ultimately inhibited fungal growth. This growth inhibition process appears as a zone of inhibition of cell growth in vitro.

CONCLUSION

Purple leaf ethanol extract (*Graptophyllum pictum* L.) had a significant effect at the 1% significance level. The ethanolic extract of purple leaves was proven to have the growth inhibition of S. aureus and C. albicans. However, purple leaf ethanol extract has more potential as antifungal.

ACKNOWLEDGEMENT

The authors would like to thank the Microbiology Laboratory of the State Islamic Institute of Palangka Raya,Central Kalimantan, which has provided a research site and has assisted in conducting the research.

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THE POTENTIAL OF PURPLE LEAVES ETHANOL EXTRACT (Graptophyllum

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POTENSI EKSTRAK ETANOL DAUN UNGU (*Graptophyllum pictum* L.) TERHADAP PERTUMBUHAN *Staphylococcus aureus* DAN *Candida albicans*

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ABSTRAK

Potensi Ekstrak Etanol Daun Ungu (Graptophyllum pictum L.) Terhadap Pertumbuhan Staphylococcus aureus dan Candida albicans. *Penelitian ini merupakan penelitian eksperimen dengan pendekatan komparatif, yang bertujuan untuk menganalisis potensi daun Ungu (Graptophyllum pictum L.) terhadap Staphylococcus aureus dan Candida albicans secara in vitro. Zona bening yang terbentuk antara sisi terluar paper disc yang mengandung ekstrak etanol daun Ungu (Graptophyllum pictum L.) dengan koloni Staphylococcus aureus dan Candida albicans merupakan indikator pertumbuhan. Pertumbuhan Staphylococcus aureus dan Candida albicans diukur pada masa inkubasi 24 jam, 48 jam, dan 72 jam, yang selanjutnya dianalisis dengan analisis dengan uji statistik Anava satu jalur dan dilanjutkan uji Duncan 1%. Hasil penelitian menemukan bahwa ekstrak etanol daun Ungu (Graptophyllum pictum L.)* memiliki daya hambat pertumbuhan *Staphylococcus aureus* dan *Candida albicans, yang dibuktikan dari hasil perbandingan konsentrasi optimal Staphylococcus aureus dan Candida albicans yaitu sebesar 50% dan 90%, sehingga ekstrak etanol daun Ungu dapat direkomendasikan sebagai antibakteri.*

Kata Kunci: *Candida albicans, Daun Ungu (Graptophyllum pictum L.), Staphylococcus aureus*

1. PENDAHULUAN

Mikroba sangat berkaitan erat dengan kehidupan sehari-hari. Mikroorganisme memiliki ciri utama yang membedakannya dengan mikroorganisme satu dengan yang lain, yaitu organisasi bahan selulernya (Waluyo, 2016). Mikroorganisme terdiri dari bakteri, virus, khamir, kapang, dan protozoa, dari semua jenis mikroorganisme tersebut, salah satu diantaranya dapat menguntungkan serta dapat merugikan. Mikroorganisme yang menguntungkan merupakan kelompok flora normal, sedangkan mikroorganisme yang merugikan memiliki kecenderungan sebagai penyebab berbagai penyakit atau disebut dengan mikroba patogen. Mikroorganisme patogen penyebab infeksi pada manusia, salah satunya adalah *Staphylococcus aureus* dan *Candida albicans* (Anggraini, Ferniah, & Kusdiyantini, 2019).

Staphylococcus aureus adalah flora normal yang terdapat pada kulit manusia dan selaput mukosa manusia (Triana, 2014), sedangkan *Candida albicans* merupakan jamur flora yang umumnya ditemukan pada rongga mulut, saluran pernafasan, saluran pencernaan dan vagina. *Staphylococcus aureus* yang jika dalam jumlah berlebih yang dapat menyebabkan radang atau abses dan menyebabkan infeksi, demikian pula dengan *Candida albicans* yang dapat menjadi pemicu infeksi patogenitas. Penanggulangan infeksi akibat mikroba umumnya dengan penggunaan antibiotik. Penggunaan antibiotik yang tidak tepat menyebabkan resistensi. Retnaningsih, Primadiamanti, & Febrinati (2019) melaporan bahwa salah satu cara untuk meminimalisir potensi munculnya resistensi antibiotik

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Hal yang sama juga pada *C. albicans*

adalah dengan penggunaan tanaman obat (*back to nature*). Lebih dari 30.000 spesies tanaman yang ada di kawasan hutan Indonesia merupakan tanaman yang berpotensi sebagai obat (Fuadi, 2019). Akan tetapi, sebagian besar masyarakat belum mengetahui jenis tanaman obat, sehingga tanaman obat lebih dianggap sebagai tumbuhan liar (Effenberger & Keifer, 1967)

Jenis tumbuhan cenderung dianggap sebagai tumbuhan liar, tetapi memiliki potensi sebagai tumbuhan berkhasiat obat adalah Daun ungu (*Graptophyllum pictum* L.*).* Tumbuhan Daun ungu dianggap sebagai kelompok semak belukar, dan hanya dianggap sebagai tumbuhan liar, sehingga cenderung diabaikan. Hasil penelitian (Effenberger & Keifer, 1967) melaporkan daun Ungu efektif terhadap berbagai infeksi, karena senyawa metabolit sekunder yang terkandung dalam daun Ungu. Komponen kimia yang terdapat dalam daun ungu adalah alkaloid, nontoksik, flavonoid, glikosid, steroid, fenol, polifenol, saponin, dan tanin. Potensi daun ungu belum banyak dikenal oleh masyarakat, karena kurang terdokumentasinya potensi daun ungu secara ilmiah. Minimnya informasi dan pengetahuan masyarakat tentang manfaat daun ungu secara berkelanjutan yang mengindikasikan perlunya literatur tentang manfaat daun ungu. Ekstrak daun ungu dinyatakan efektif sebagai antibakteri *Staphylococcus aureus.* Temuan akhir penelitian ini diharapkan potensi ekstrak etanol daun ungu sebagai antibakteri dapat terdokumentasi secara ilmiah.

2. METODE PENELITIAN

Penelitian ini merupakan penelitian eksperimental laboratoris komparatif, dengan tujuan untuk mengetahui perbandingan potensi ekstrak etanol daun Ungu terhadap *Staphylococcus aureus* dan *Candida albicans*. Pengukuran data hasil penelitian dilakukan setelah perlakuan penelitian. Penelitian dilakukan di Laboratorium Mikrobiologi Institut Agama Islam Negeri Palangka Raya, Kalimantan Tengah. Indikator penghambatan pertumbuhan mikroba diukur berdasarkan zona hambat pertumbuhan yang ditandai dengan zona bening yang terbentuk antara koloni *Staphylococcus aureus* pada medium lempeng Nutrien Agar dan koloni *Candida albicans* pada medium lempeng SDA dengan sisi terluar *paper disc* yang mengandung ekstrak etanol daun ungu. Pengamatan pertumbuhan *Staphylococcus aureus* dan *Candida albicans* dilakukan pada masa inkubasi 24 jam, 48 jam, dan 72 jam setelah perlakuan.

Alat dan Bahan

Preparasi Stok Biakan

Tahapan preprasi stok induk biakan mikroba diawali dengan menyiapkan medium *nutrient both* dan menginokulasikan koloni mikroba yang berasal dari biakan ke dalam medium sebanyak 1 ose secara aseptic (Waluyo, 2016). Medium *nutrient both* yang telah diinokulasikan koloni *Staphylococcus aureus* dan *Candida albicans* diinkubasikan selama 48 jam pada suhu 37˚ C. Prosedur inkubasi bertujuan untuk optimalisasi pertumbuhan mikroba (Aulia, Khamid, & Aninjaya, 2011).

Analisis Potensi Daun Ungu (*Graptophyllum pictum* L.) Terhadap *Staphylococcus aureus* dan *Candida albicans*

Analisis antimikroba *Staphylococcus aureus* dan *Candida albicans* sebelumnya dilakukan dengan membiakan *Staphylococcus aureus* dan *Candida albicans* pada medium cair dan diinkubasi selama 24 Jam. Tahap perlakuan penelitian dilakukan dengan menyiapkan medium lempeng *nutrient agar* (NA) dan *Sabaroud Dextrose Agar* (SDA).

Kedua jenis medium masing-masing dilarutkan dalam *Aquades*t, dan dihomogenisasi di atas *hot plate stirrer*. Selanjutnya sebanyak 15ml ke medium dimasukan dalam cawan petri

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dan disterilasi basah menggunakan autoklaf pada suhu 121^{0}C dengan tekanan 15 lbs selama 15 menit (Anggraini & Kusiantini 2019). Medium yang sudah siap selanjutnya digunakan untuk penanaman mikroba *Staphylococcus aureus* dan *Candida albicans.*

Kultur cair *Staphylococcus aureus* dan *Candida albicans* yang telah diinkubasi digoyang perlahan selama 3 menit, dengan tujuan agar penyebaran koloni mikroba merata Kultur cair *Staphylococcus aureus* dan *Candida albicans* ditanam sebanyak 0,5ml pada masing-masing medium secara merata. Selanjutnya, *paper disc* yang telah disiapkan direndam pada masing-masing konsentrasi sesuai dengan perlakuan penelitian, yaitu 40%, 50%, 60%, 70%, 80%, 90%. Perendaman dilakukan selama 1 menit. Keseluruhan *paper disc* yang telah direndam dalam ekstrak daun Ungu selanjutnya diletakkan ke bagian tengah-tengah permukaan medium lempeng NA & SDA secara aseptik menggunakan metode cakram. Medium yang telah diberikan perlakuan diinkubasikan pada suhu 37 ˚ C. Pengambilan data dilakukan pada masa inkubasi 24 jam, 48 jam, dan 72 jam.

Analisis Data

Data pengamatan dilakukan setelah pemberian perlakuan, yaitu pada masa inkubasi 24jam, 48jam, dan 72jam. Analisis data hasil pengamatan selanjutnya dilakukan dengan analisis uji statistik *Anava one way analysis* dan dilanjutkan uji Duncan 1%.

3. HASIL DAN PEMBAHASAN

Data hasil penelitian meliputi zona hambat pertumbuhan *Staphyloccous aureus* dan *Candida albicans*. Pengambilan data dilakukan saat biakan *Staphylococcus aureus* dan *Candida albicans* berumur 24jam, 48jam, dan 72jam pada suhu yang telah diatur 37°C.

Data Perlakuan Ekstrak Etanol Daun Ungu (*Grptophyllum pictum* L.) terhadap *Staphylococcus aureus*

Data hasil pengamatan zona hambat pertumbuhan bakteri *Staphylococcus aureus* pada medium dasar Nutrien Agar (NA) yang disajikan pada Tabel 1.

Tabel 1 Uji Duncan 1% Zona Hambat Pertumbuhan *Staphylococcus aureus*

Perlakuan		Rerata Zona Hambat (mm)					
		24 jam		48 jam		72 jam	
Chloramfenicol 0.1% (+)		4.64	b	4.72	b	4.84	b
Aquades (-)		0.00	a	0.00	a	0.00	a
Konsentrasi	40%	4.04	b	5.44	bc	7.14	bcd
	50%	6.54	c	7.94	d	9.02	d
	60%	8.64	c	8.72	d	8.84	d
	70%	3.54	b	4.96	bc	5.02	bc
	80%	3.14	b	4.34	bc	4.84	bcd
	90%	8.24	c	9.24	cd	9.54	cd

Keterangan
Notasi yang berbeda pada kolom yang sama menunjukkan perbedaan yang signifikan berdasarkan uji DMRT 1%

Data rekapitulasi pada Tabel 1 di atas memiliki rata-rata zona hambat yang variatif, di mana *Chloramfenicol* 0.1% sebagai kontrol positif penelitian memiliki rerata zona hambat yang lebih rendah dibandingkan dengan rerata

Commented [VK5]: Mohon menggunakan fungsi simbol

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Komentar yang sama untuk Tabel 2.

Commented [VK11]: Analisis statistik pada 48 dan 72 jam masih salah.
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zona ekstrak daun Ungu. Pada waktu pengamatan 24 jam, 3.51 mm (*Chloramfenicol* 0.1%). Hal ini menunjukkan daya hambat ekstrak terhadap pertumbuhan *Staphylococcus aureus* pada konsentrasi tertentu lebih kuat dibandingkan kontrol positif penelitian. Data tersebut juga dipertegas dengan hasil uji duncan 1% pada pengamatan 24 jam yaitu konsentrasi terkecil yang memiliki daya hambat yang hampir sama konsentrasi yang lebih tinggi adalah konsentrasi 50%, sehingga konsentrasi 50% diinterpretasikan sebagai konsentrasi efektif penelitian.

Pengamatan 48 jam atas menunjukkan bahwa perlakuan ekstrak etanol daun ungu (*Graptophyllum pictum* L.) berpengaruh nyata terhadap *Staphylococcus aureus*. Perlakuan berupa pemberian ekstrak etanol daun ungu pengaruhnya hampir sama dengan pengamatan 24 jam. Konsentrasi efektif yaitu konsentrasi 50% dinterpretasikan sebagai konsentrasi efektif dalam menghambat pertumbuhan *Staphylococcus aureus.* Pengamatan dilanjutkan pada masa inkubasi 72 jam menunjukkan terjadinya penurunan daya hambat yang sangat signifikan pada masa inkubasi 72 jam, notasi menunjukkan konsentrasi yang lebih besar seperti P_8 (90%) yang tidak berbeda secara statistik dengan konsentrasi yang lebih rendah seperti P_5 (60%). Data menggambarkan bahwa konsentrasi 50% masih memiliki kemampuan yang sama dengan masa inkubasi 24 jam dan 48 jam. Hal tersebut dapat diinterpretasikan bahwa konsentrasi 50% merupakan konsentrasi yang efektif dalam menghambat pertumbuhan bakteri *Staphylococcus aureus.*

Berdasarkan data di atas, dapat diketahui bahwa konsentrasi 50% pada ekstrak etanol daun ungu efektif dan mampu menghambat pertumbuhan *Staphylococus aureus*. Hal tersebut disebabkan daun ungu mengandung senyawa metabolit sekunder yang berfungsi sebagai antibakteri. Hal ini dikarenakan daun ungu memiliki senyawa metabolit sekunder berupa flavonoid dan alkaloid Sejalan dengan penelitian Aulia, Khamid, & Aninjaya, (2011) yang mengatakan bahwa daun ungu dapat digunakan sebagai obat antibakteri.

Ektrak etanol daun ungu mengandung senyawa metabolit sekunder berupa flavonoid dan alkaloid yang memiliki manfaat sebagai penghambat mikroorganisme salah satunya bakteri *Staphylococcus aureus*. Hasil penelitian dari Retnaningsih, Annisa Primadiamanti, 2019) mempertegas bahwa daun ungu (*Graptophyllum pictum* L.) mempunyai kandungan senyawa metabolit sekunder seperti alkaloid, flavonoid, saponin, steroid dan tannin. Hasil dari penelitian tersebut menegaskan bahwa salah satu kandungan yang dimiliki oleh daun ungu seperti flavonoid dan alkaloid terbukti bersifat sebagai antibakteri, sehingga temuan dari hasil penelitian ini sejalan dengan penelitian sebelumnya dimana ekstrak daun ungu terbukti memiliki daya hambat terhadap pertumbuhan *Staphylococcus aureus*. Mean zona hambat pertumbuhan *Staphylococcus aureus* disajikan pada Gambar 1.

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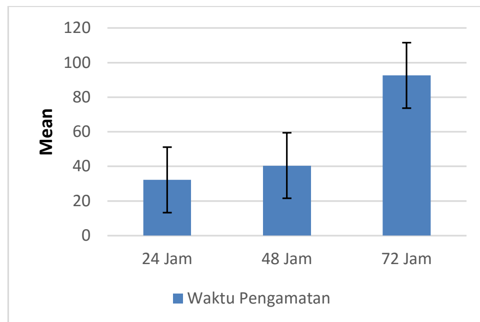

Gambar 1 Mean Zona Hambat Pertumbuhan *Staphylococcus aureus*

Nilai *mean* pada Gambar 1 memberikan gambaran bahwa inkubasi 72 jam memiliki capaian optimalisasi pengaruh yang lebih besar dibandingkan 24 jam dan 48 jam, sehingga hasilnya dapat dijadikan indikator penentuan konsentrasi yang paling efektif dalam formulasi. Pengamatan zona hambat pertumbuhan *Staphylococcus aureus* dipertegas dengan perbandingan hasil uji Duncan disajikan Tabel 1.

Data Perlakuan Ekstrak Etanol Daun Ungu (*Grptophyllum pictum* L.) terhadap *Candida albicans*

Data hasil pengamatan zona hambat pertumbuhan bakteri *Candida albicans* pada medium SDA disajikan pada Tabel 2.

Tabel 2. Uji Duncan 1% Zona Hambat Pertumbuhan *Candida albicans*

Perlakuan		Rerata Zona Hambat (mm)					
		24 jam		48 jam		72 jam	
Albothyl 0.25% (+)		5.74	b	6.04	b	26.44	d
Aquades (-)		0.00	a	0.00	a	0.00	a
Konsentrasi	40%	14.04	c	14.04	c	14.34	bcd
	50%	6.54	b	8.74	b	17.74	bc
	60%	8.74	b	8.72	d	3.54	bcd
	70%	17.44	c	18.24	c	18.94	bcd
	80%	17.14	c	17.74	c	19.14	cd
	90%	12.14	c	14.94	c	16.04	bcd

Keterangan
Notasi yang berbeda pada kolom yang sama menunjukkan perbedaan yang signifikan berdasarkan uji DMRT 1%

Data rekapitulasi pada Tabel 2 memiliki rata-rata zona hambat *Albothyl* 0.25% sebagai kontrol positif penelitian memiliki rerata zona hambat yang lebih rendah dibandingkan dengan rerata zona ekstrak etanol daun Ungu. Hal ini menunjukkan daya hambat ekstrak terhadap pertumbuhan *Candida albicans* lebih kuat dibandingkan kontrol positif penelitian. Data tersebut juga dipertegas dengan hasil uji duncan 1% pada pengamatan 24 jam yaitu dapat diinterpretasikan bahwa taraf perlakuan yang efektif ekstrak etanol daun ungu pada waktu pengamatan 24 jam adalah konsentrasi 40% (P_3). Hasil pengamatan konsentrasi efektif dan optimum ekstrak daun ungu pada masa inkubasi 24 jam sejalan dengan pernyataan (Maya

Commented [VK15]: Mohon lebih jelas mengenai nilai *mean*.
Tidak ada informasi jelas mengenai maksud nilai mean. Misalnya apakah mean disini berarti "rerata"? apabila nilai *mean* ini bukan rerata apakah ada perhitungannya sehingga menghasilkan nilai sebesar 20 atau 80? dari mana asal nilai *mean*? apa satuan dari nilai *mean*?

Commented [VK16]: Analisis statistik pada 48 dan 72 jam masih salah.
Mohon lebih berhati2 dalam pemberian notasi.

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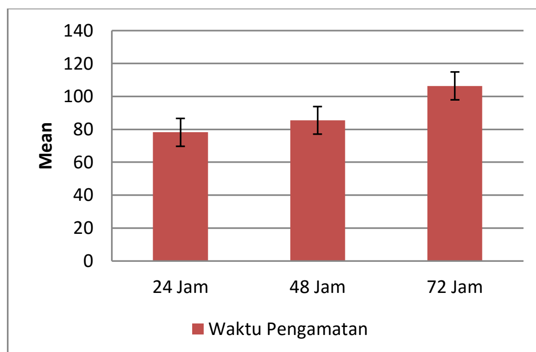
Ayuningtias, 2017) bahwa ekstrak etanol daun ungu (*Graptophyllum pictum* L.) mempunyai aktivitas antijamur terhadap *Candida albicans*. Pengamatan pada masa inkubasi 48 jam menunjukkan bahwa taraf perlakuan yang efektif ekstrak etanol daun ungu pada waktu pengamatan 48 jam adalah konsentrasi 40% (P3). Konsentrasi efektif pada waktu pengamatan 48 jam tidak berbeda dengan 24 jam, sehingga dapat dimaknai bahwa konsentrasi 40% masih memiliki daya hambat yang sama sampai dengan waktu 48 jam. Daya hambat ini dipengaruhi oleh kandungan flavonoid yang terdapat pada ekstrak etanol daun ungu dapat berfungsi sebagai antifungi (Husadani et al., 2017) Efektifitas senyawa metabolit sekunder dalam ekstrak etanol sebagai antijamur selanjutnya dilakukan pengamatan sampai 72 jam, pada pengamatan pada 72 jam menunjukkan bahwa Albothyl 0.25% memiliki zona hambat yang paling besar. Data ini menunjukkan bahwa efektifitas senyawa metabolit sekunder yang terdapat dalam ekstrak etanol daun Ungu hanya mampu bertahan sampai pada 48 jam, sedangkan pada waktu 72 jam memiliki daya hambat yang tidak lebih baik dari antifungi pada albothyl 0.25.

Hasil analisis statistik menunjukkan ekstrak etanol daun Ungu berpengaruh signifikan dengan nilai Sig. 0.000 < 0.01, baik pada waktu inkubasi 24 jam, 48 jam, maupun 72 jam. Akan tetapi, jika dilihat dari perbandingan nilai *mean* (Gambar 2), masa inkubasi 72 jam memiliki nilai *mean* yang lebih besar dibandingkan waktu inkubasi lainnya.



Gambar 2 Mean Zona Hambat Pertumbuhan *Candida albicans*

Perbandingan *mean* pada Gambar 2, di mana perbandingan *mean* memberikan fakta masa inkubasi 72 jam memiliki perbedaan pengaruh jauh lebih besar dibandingkan 24 jam dan 48 jam, sehingga hasilnya dapat dijadikan indikator penentuan konsentrasi yang paling efektif. Untuik mengetahui kecenderungan potensi daun ungu sebagai antimikroba, dapat dilihat dari perbandingan daya hambat daun ungu terhadap *Staphylococcus aureus* dan *Candida albicans* sebagaimana disajikan pada Gambar 3.

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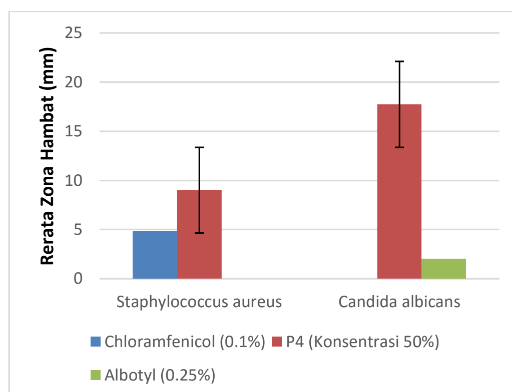

Gambar 3 Perbandingan daya hambat yang terbentuk dari *Staphylococcus aureus* dan *Candida albicans*

Gambar 3 di atas memberikan ilustrasi perbandingan daya hambat yang terbentuk dari *Staphylococcus aureus* dan *Candida albicans*. Jika dilihat dari perbandingan dari gambar di atas dapat diinterpretasikan bahwa ekstrak etanol daun ungu memiliki potensi yang lebih besar sebagai antifungi. Hal tersebut berdasarkan zona hambat terbentuk yaitu sebesar 17.74 mm. Sejalan dengan pernyataan Husadani (2017) bahwa ekstrak etanol daun ungu (*Graptophyllum pictum* L.) memiliki efek antifungi terhadap pertumbuhan *Candida albicans*. Ekstrak etanol daun ungu dapat menghambat pertumbuhan *Candida albicans* atau berpotensi sebeagai antifungi dikarenakan mengandung senyawa metabolit sekunder berupa saponin. Sejalan dengan penelitian (Husadani et al., 2017) bahwa saponin mempunyai efek antijamur atau antifungi. Saponin bekerja dengan cara merusak membran sitoplasma sehingga dapat menghambat pertumbuhan *Candida albicans.*

SIMPULAN

Ekstrak etanol daun ungu (*Graptophyllum pictum* L.) memiliki pengaruh yang signifikan pada taraf signifikasi 1%. Ekstrak etanol daun ungu terbukti memiliki daya hambat pertumbuhan *Staphylococcus aureus* dan *Candida albicans.* Namun, ekstrak etanol daun ungu lebih berpotensi sebagai antibakteri.

UCAPAN TERIMAKASIH

Penulis mengucapkan terima kasih kepada Laboratorium Mikrobiologi Institut Agama Islam Negeri Palangka Raya, Kalimantan Tengah yang telah meyediakan tempat penelitian dan telah membantu dalam pelaksanaan penelitian.

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