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Comparison of antimicrobial activities of ethanol extract from three species of ganoderma original lombok island

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Abstract. The use of antibiotics is one of the most important ways to deal with the spread and treatment of pathogenic microbial infections. The search for new antibiotic sources continues to be carried out to anticipate the emergence of microbial resistance. One of the natural resources that has the potential as an antimicrobial source is a member of the macrofungi of the Genus Ganoderma. The purpose of this study was to evaluate the antimicrobial performance of the ethanol extracts of *Ganoderma lucidum*, *G. applanatum* dan *Ganorderma* sp. against fungi (*Candida albicans* dan *Cryptococcus neoformans*), gram positive bacteria (*Bacillus cereus* dan *Staphylococcus aureus*) and gram negative bacteria (*Escherichia coli* dan *Shigella* sp.). Macrofungi samples were taken from the forest area of Nature Tourism Park (TWA) Gunung Tunak, TWA Kerandangan, TWA Suranadi, TWA Nuraksa Sesaot, TWA Lemor and Pusuk forest. The stages of the method performed are sample collection, sample preparation, extraction, and testing of antimicrobial activity using the well difusion method. The ethanol extract concentrations for testing were 20%, 40%, 60% and 80%. The results showed that the three Ganoderma species had anti-fungal and antibacterial activity and that different levels of concentration had an effect on inhibition. The size of the inhibition zone is directly proportional to the higher the extract concentration. The antimicrobial activity of the ethanol extract of *G. lucidum* was higher when compared to *G. applanatum* and *Ganoderma sp.* both against fungi (*Candida albicans* and *Cryptococcus neoformans*) as well as against gram-positive and gram-negative test bacteria. In addition, *G. applanatum* showed very weak inhibition against both groups of tested bacteria.
Key words: *Candidiasis, Cryptococcosis,* comorbid infections, macerations, pathogens

1. Introduction

Until the 21st century, infectious diseases remain a significant contributor to morbidity and mortality not only in developing countries but also in developed countries. Infectious diseases by bacteria, which were previously considered to be “finished”, are being handled well, apparently becoming a new challenge along with the development of multi-drug resistant bacterial strains [1].

Not only that, but fungal diseases have claimed more than 1.5 million lives and affected more than one billion people. However, fungal infections are still a topic of neglect by public health authorities even though most deaths from fungal diseases can be avoided. Serious yeast infections occur as a result of other health problems including asthma, AIDS, cancer, organ transplantation, and corticosteroid therapy [2, 3].

Diseases caused by fungi are also the most common comorbid infections in people with AIDS, especially candidosis caused by *Candida sp*., Cryptococcosis by *Cryptococcus neoformans*, aspergillosis by *Aspergillus* sp., And histoplasmosis by pathogenic fungi, namely *Histoplasma capsulatum* [4], which globally found tens of thousands to millions of cases of infection caused by

pathogenic fungi [5,6,7]. The first three functions are opportunistic. Parasitic and fungal infections affecting people with AIDS will increase morbidity and mortality.

The use of antibiotics is one way to overcome the spread of the infection. Antibiotics as drugs to combat infectious diseases, their use must be rational, precise, and safe. Irrational use of antibiotics will have negative effects, such as the resistance of microorganisms to some antibiotics, increased drug side effects [8].

Research on the activity of a compound as an antimicrobial is a first step to provide important information as an effort to overcome a disease resistance caused by bacteria and fungi. Several types of fungi, especially from the Ganoderma genera, have long been known as sources of medicine because of their bioactive compounds [9,10].

Studies on the bioactive content and potential of *Ganoderma* which inhabit the forest area of Lombok Island as a source of medicine have not been widely carried out. According to [11], Lombok Island is one of the islands in the Lesser Sunda Islands region which has lowland tropical rainforest areas and semi-evergreen rainforest areas that can be found on Mount Rinjani. The forest on the island of Lombok is included in the category of rainforest which has high biodiversity including the diversity of fungi.

The uniqueness of the geographical location of Lombok Island which is in the transitional route of West Wallacea and East Wallacea allows the discovery of unique species of animals, plants, and microorganisms. These unique characteristics are thought to affect the bioactive content and composition of Ganoderma. This may occur because the characteristics of the Ganoderma host plants that are in the transitional zone represent the characteristics found in both clamp zones.

This paper presents the results of research on the antimicrobial activity of ethanol extraction from *Ganoderma lucidum*, *Ganoderma applanatum*, and *Ganoderma* sp. originating from the Kerandangan Nature Park (TWA) forest area, TWA Suranadi, TWA Nuraksa Sesaot, TWA Lemor, TWA Gunung Tunak, and Pusuk Forest in inhibiting the growth of fungi (*Candida albicans* and *Cryptococcus neoformans*), gram-positive bacteria (*Bacillus cereus* and *Staphylococcus aureus*) and gram-negative bacteria (*Escherichia coli* and *Shigella* sp.).

2. Material and methods

2.1 Sample Preparation

Samples of *Ganoderma lucidum*, *Ganoderma applanatum*, and *Ganoderma* sp. taken from the forest area of Suranadi Nature Tourism Park (TWA), TWA Sesaot, TWA Kerandangan, TWA Lemor, TWA Gunung Tunak, and Pusuk Forest. Harvesting is done by cutting the fruit body of the Ganoderma mushroom and then placing it in a zip lock or sterile plastic [12]. The distribution of the locations of the three Ganoderma samples can be seen in Table 1.

Table 1. Distribution of the location of the discovery of *Ganoderma lucidum, Ganoderma applanatum,* and *Ganoderma* sp.

Species	**Location**	**Host**
Ganoderma applanatum	Pusuk Forest , TWA Kerandangan, TWA Lemor, TWA Tunak Forest, TWA Suranadi	dead tree trunk or branches, live tree trunk
Ganoderma lucidum	TWA Tunak Forest, TWA Suranadi & Pusuk Forest	dead tree trunk or branches
Ganoderma sp.	TWA Suranadi	live tree trunk

Furthermore, the sample is cleaned of all dirt and then dried and cut into small pieces then oven at 40 °C until dry..

2.2 Sample Extraction

Samples were blended and macerated using 95% ethanol solvent for 5 days in a tightly closed vial tube with regular stirring and carried out every day [13]. After that, it is filtered and the solvent is evaporated using an evaporator. After that, the maceration results are filtered to obtain macerate. The ethanol macerate obtained was then concentrated using an evaporator at a temperature of 40 ^{o}C. The viscous extract was dissolved using DMSO 50% according to the concentration for testing, namely 20%, 40%, 60%, and 80% [14].

2.3 Percentage of Extract Yield

The yield is the percentage of the raw material that can be used or utilized from the total raw material, so the calculation of the percentage yield is as follows [15]:

$$\%\ \text{Yield} = \frac{Weigt\ Extract\ \ (gr)}{Weight\ of\ Simplisia\ (gr)} \text{ x } 100\%$$

2.4 Making Media

The medium used for bacterial culture rejuvenation is Nutrient Agar (NA) medium, and for fungus rejuvenation is Sabouraud Dextrose Agar (SDA). The test medium used for the antibacterial activity test was Mueller Hinton Agar (MHA) medium.

NA media is made by dissolving 20 grams of powdered NA media (Oxoid) in distilled water, up to a volume of 1 liter. The media solution was heated until the NA media powder was completely dissolved. The NA media that has been homogeneous in Erlenmeyer is then sterilized using an autoclave for 15 minutes at a pressure of 1 atm, a temperature of 121 ^{o}C. The composition of the NA medium was 10 g beef extract, 10 g peptone, 5 g NaCl, 1,000 ml distilled water and 15 gL-1 agar.

Making Sabouraud Dextrose Agar (SDA) media is as follows: 27.5 grams of Dextrose, 12.5 grams of Nutrient Agar, and 5 grams of Peptone are weighed and mixed with 500 ml of distilled water in Erlenmeyer then heated while stirring until boiling on a hot plate. After boiling, the media was sterilized by autoclaving at a temperature of 121 ºC and a pressure of 2 atm for 30 minutes.

A total of 38 grams of Mueller Hinton Agar Oxoid was dissolved in 1 liter of distilled water and then brought to a boil. The media solution was then sterilized in an autoclave at a temperature of 121 ^{o}C and a pressure of 2 atm for 30 minutes. The sterile media was cooled to a temperature of 45 ^{o}C then poured into sterile petri dishes until it reached a thickness of 4-5 mm aseptically. The composition of the MHA medium was beef dehydrate infusion of 300 gL-1, casein hydrolisat 17.5 gL-1, starch 1.5 gL-1, agar 17 gL-1.

2.5 Rejuvenation of Tested Microbial

Tested microbes must be rejuvenated before being used for antimicrobial activity testing. This rejuvenation aims to obtain tested microbial cultures that are still active in their growth and metabolism. The test culture from the mother stock was inoculated by the quadrant streak method on the prepared media and then incubated at 30 ^{o}C for 24 hours.

2.6 Antimicrobial Bioactivity Test of Ganoderma Extract

This anti-microbial bioactivity test was carried out using the agar diffusion method, namely the well method. This method is used to ensure the presence of antimicrobial activity in the ethanol extract of Ganoderma. The parameter used is the diameter of the formed inhibition zone.

The extract solutions were made with several concentrations, namely 20%, 40%, 60% and 80% v / v using DMSO 50% solvent. The suspension of the test fungus which has been adjusted to the Mc Farland turbidity is scratched using a cotton swab on SDA or MHA media until it is flat (covering the entire surface of the test media), then a hole is made in the media with a diameter of 7 mm using a sterile hole. Each well was piped as much as 100 µL of extract from each concentration that had been

made. After that it was incubated at 30 ^{o}C. The repetition is done three times. The positive control used was a synthetic antibiotic metronidazole 200 mg and cyprofloxacin.

2.7 Inhibition Category

The determination of growth inhibition response categories according to [16] can be seen in Table 2

Table 2 Classification of response to microbial growth inhibition

Diameter of Inhibition Zone	Respons of Growth inhibition
>20 mm	Very strong
16-20 mm	Strong
10-15 mm	medium
< 10 mm	Weak

3. Result

3.1 Results of Extraction of Three Species of Ganoderma

Sample preparation of three Ganoderma species obtained dry samples (simplicia) in powder form, with the aim of expanding the surface of the sample in contact with the solvent so that the yield obtained is greater in extraction. Table 3 below is the amount of simplicia and the immersion percentage obtained from the extraction.

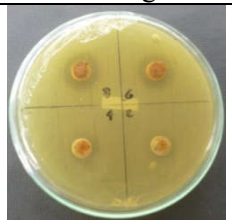
Table 3. Percentage of Ethanol Extract Yield of Three Ganoderma Species

Ganoderma Species	Weight simplicia (gr)	Yield of Extract (gr)	Yield of Extract (%)
Ganoderma applanatum	192,8	6	3,11
Ganoderma lucidum	209,6	5	2,39
Ganoderma sp.	182,3	4	2,19

Table 3 above shows that the extraction results obtained are very little. So that to obtain even more extracts, a sufficient number of samples are required. For *Ganoderma applanatum*, the extracted results were obtained in the form of a very thick solution with a blackish-brown color, *Ganoderma lucidum* in the form of a thick dark brown solution and *Ganoderma* sp. in the form of a thick yellowish-brown solution and there are dark brown lumps.

3.2 Antimicrobial Activity of Ganoderma Ethanol Extract

Based on the test results of the ethanol extract against the tested fungi and bacteria, the inhibition zone was obtained (Figure 1), this means that the extracts of *Ganoderma lucidum*, *Ganoderma applanatum* and *Ganoderma* sp. has an antimicrobial substance which has inhibitory activity against *Candida albicans*¸ *Cryptococcus neoformans, Staphilococcus aureus, Bacillus cereus, Echerichia coli* and *Shigella sp.*

Ethanol Extract	Tested Microbial		
	Fungi	G+Bacteria	G-Bacteria
G. lucidum			
	Candida albicans	*Staphilococcus aureus*	*Echerichia coli*

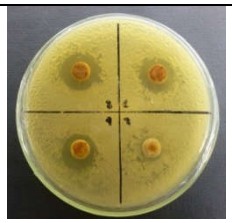
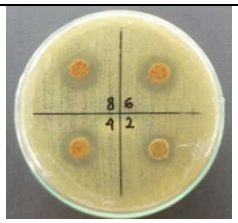
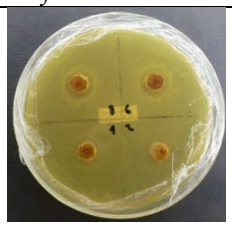
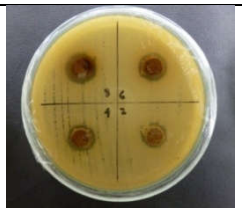
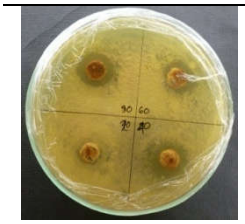
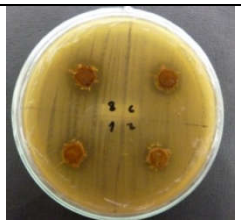
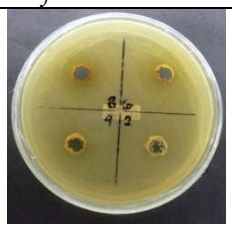
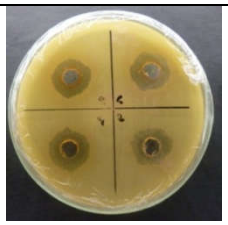
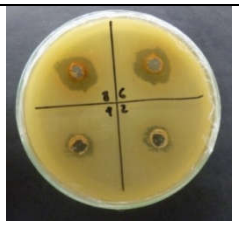
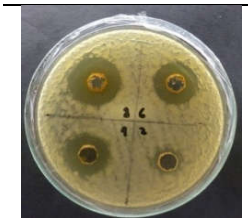
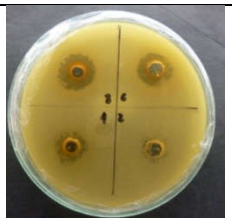
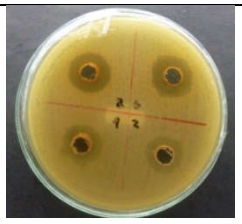
	 *Cryptococcus neoformans*	 *Bacillus cereus*	 *Shigella sp.*
G.applanatum	 *Candida albicans*	 *Staphilococcus aureus*	 *Echerichia coli*
	 *Cryptococcus neoformans*	 *Bacillus cereus*	 *Shigella sp.*
Ganoderma .sp	 *Candida albicans*	 *Staphilococcus aureus*	 *Echerichia coli*
	 *Cryptococcus neoformans*	 *Bacillus cereus*	 *Shigella sp.*

Figure 1. Inhibition Zone test results of ethanol extract of three Ganoderma species

The results of measurements of the inhibition zone diameter of the three Ganoderma species against *Candida albicans*¸ *Cryptococcus neoformans, Staphilococcus aureus, Bacillus cereus, Echerichia coli* and *Shigella* sp. presented in Table 4.

Tabel 4. Diameter zona hambat ekstrak etanol ketiga spesis Ganoderma terhadap mikroba uji

	Con (%)	Fungi		G- Bacteria		G+ bacteria	
		C. albicans	*C. neoformans*	*E. coli*	*Shigella* sp.	*S. aureus*	*B. cereus*
G. applanatum	20	**0,00**	6,67	4,00	3,00	7,00	11,67
	40	0,00	10,33	4,33	7,00	11,00	14,00
	60	7,67	14,67	12,33	11,67	12,67	16,00
	80	8,00	15,30	14,00	12,33	14,33	18,00
G. lucidum	20	5,00	7,33	11,33	13,00	4,00	12,67
	40	12,33	14,33	14,00	15,33	12,00	15,33
	60	17,33	19,67	16,00	17,00	13,67	16,33
	80	19,00	**20,67**	17,67	18,00	15,33	19,00
Ganoderma sp.	20	3,33	7,33	10,33	15,33	12,00	10,33
	40	7,00	11,33	13,00	16,67	14,00	12,00
	60	11,67	13,67	17,67	18,00	16,00	15,00
	80	13,67	15,33	19,67	19,00	18,00	17,00

In general, the data in Table 4 shows that the lowest antimicrobial activity was obtained by the ethanol extract of *G. applanatum* against the fungus *C. albicans* which was 0 mm at a concentration of 20% and the highest was achieved by *G.lucidum* against *C. neoformans* which was 20.67 mm at concentration 80%..

The results of measurement of the inhibition zone diameter of the ethanol extract of *Ganoderma applanatum* showed that the ethanol extract of *G. applanatum* had weak inhibition against gram-negative bacteria (*E.coli*) at concentrations of 20% and 40%, strong inhibition at concentrations of 60% and 80%. The ethanol extract of *G. applanatum* has weak inhibitory power against gram-negative bacteria (*Shigella* sp.) At a concentration of 20%, moderate inhibition at a concentration of 40%, strong inhibition at a concentration of 60% and 80%. The ethanol extract of *G. applanatum* had moderate inhibition against gram-positive bacteria (*S. aureus*) at a concentration of 20%, strong inhibition at concentrations of 40%, 60%, and 80%. The ethanol extract of *G. applanatum* has strong inhibition against gram-positive bacteria (*B. cereus*) at all concentrations.

The inhibition zone diameter of the *Ganoderma lucidum* ethanol extract 19.67-20.67mm indicates that *G. lucidum* has strong to very strong inhibition against *Cryptococcus neoformans* at a concentration of 60-80%. Strong inhibition against gram-negative bacteria (*E. coli* and *Shigella* sp.) and gram-positive bacteria (*B. cereus*) at all concentrations. Meanwhile, gram-positive bacteria (*S. aureus*) had a weak inhibitory power at a concentration of 20%, strong inhibition at a concentration of 40%, 60%, and 80%. Meanwhile, the diameter of the inhibition zone of the ethanol extract of *Ganoderma* sp. showed that the ethanol extract of *Ganoderma* sp. has strong inhibitory power against gram-negative bacteria (*E.coli* and *Shigella* sp.) and gram-positive bacteria (*S. aureus* and *B. cereus*) at all concentrations..

Graph 2, 3, and 4 below are the inhibitory activity of the ethanol extract of the three Ganoderma species against the test fungi group (*Candida albicans* and *Cryptococcus neoformans*), gram-positive bacteria. (*Staphilococcus aureus* dan *Bacillus cereus*) and gram-negative bacteria (*Echerichia coli* and *Shigella sp.*).

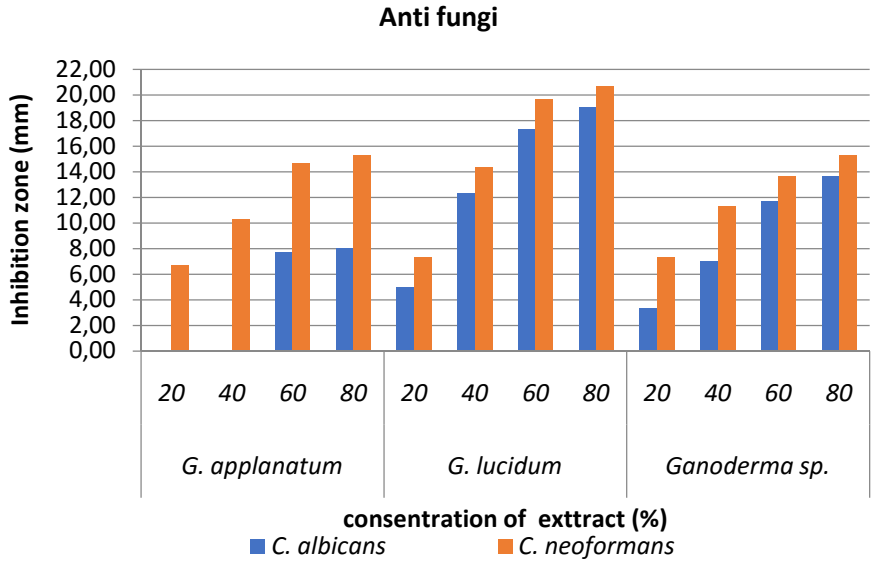


Figure 2. The results of the antifungal activity test of the three Ganoderma ethanol extracts against *Candida albicans* and *Cryptococcus neoformans,* repetition is done 3 times

Figure 2 shows that the ethanol extract of *Ganoderma lucidum* has higher antifungal activity when compared to *G.applanatum* and *Ganoderma* sp., both against *Candida albicans* and *Cryptococcus neoformans*. However, the antifungal activity of the three Ganoderma ethanol extracts was more effective against *Cryptococcus neoformans* than against *C. albicans*..

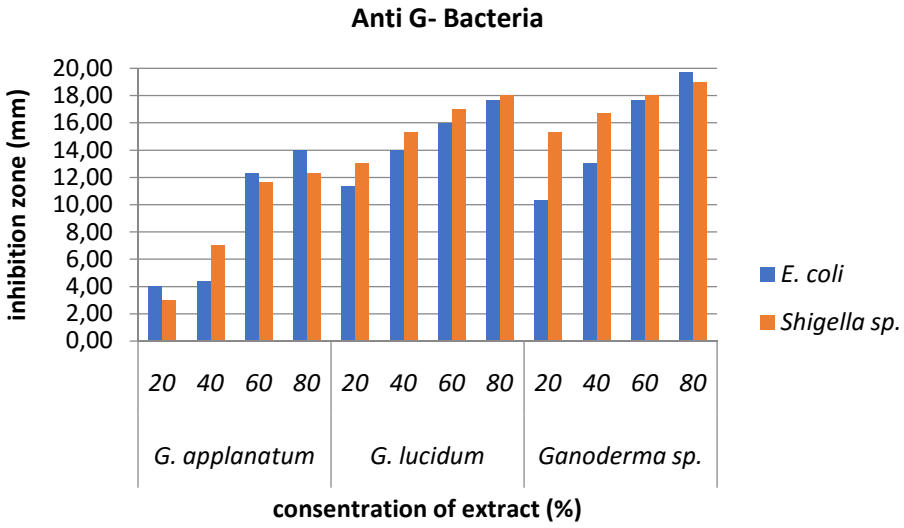


Figure 3. The results of the antifungal activity test of the three Ganoderma ethanol extracts against *Echerichia coli* and *Shigella sp.,* repetition is done 3 times

Figure 3 shows that the antimicrobial activity of *Ganoderma lucidum* and *Ganoderma* sp. has a higher gram-negative antibacterial activity when compared to *G.applanatum,* both against *E.coli* and against *Shigela* sp..

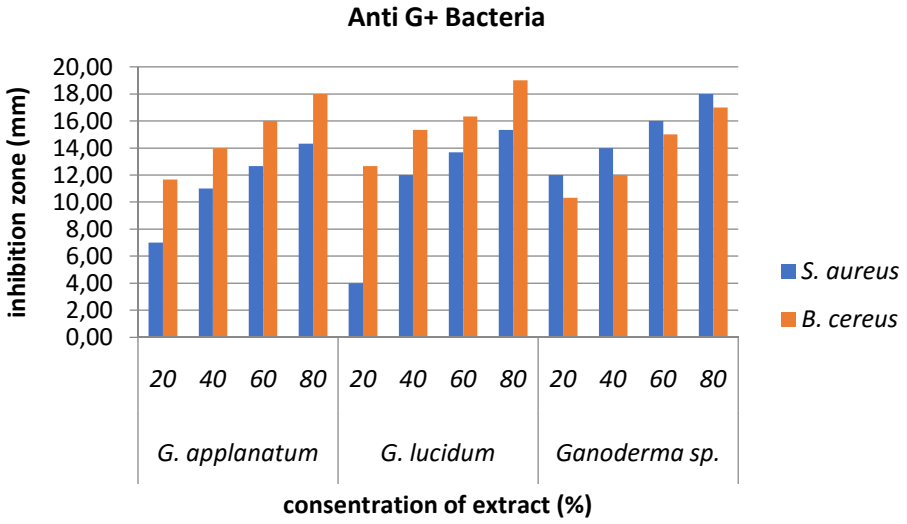


Figure 4. The results of the antifungal activity test of the three Ganoderma ethanol extracts against *Staphilococcus aureus* and *Bacillus cereus,* repetition is done 3 times

Figure 4 shows that the ethanol extract activity of the three ganodermas was quite good against gram-positive bacteria. However, *Ganoderma lucidum* and *G.applanatum* were better at inhibiting the growth of *Bacillus cereus* than their inhibition against *Staphylococcus aureus*. Meanwhile, *Ganoderma* sp. The inhibitor activity was stronger against *S. aureus* when compared to *B. cereus*.

From the graphs 2, 3 and 4 above, it can also be seen that the increase in extract concentration has an effect on the diameter of the formed inhibition zone. The higher the extract concentration level, the greater the inhibition zone formed. This means that the high concentration is directly proportional to the size of the zone of inhibition..

In this test, controls were made, namely positive controls and negative controls. The positive control was metronidazole for anti-fungal, while for antibacterial, the antibiotic Ciprofloxacin was used. Control is used for the purpose of comparison so that it can be seen whether the ethanol extract of the three Ganoderma species has the same antifungal or antibacterial activity as synthetic antibiotics. Meanwhile, negative control is used to determine whether the solution used has antifungal activity or not. The negative control was distilled water and 50% DMSO. The results of positive and negative control antimicrobial tests can be seen in Table 5.

Table 5. Antimicrobial test results of positive and negative controls on fungi and bacteria

Tested Microbial	Positive control (mm)		Negative control (mm)	
	Metronidazole	Ciprofloxacin	Aquadest	DMSO 50%
Candida albicans	11	-	0	0
Cryptococcus neoformans	20	-	0	0
Escherichia coli	-	22	0	0
Shigella sp.	-	26	0	0
Staphylococcus aureus	-	25	0	0
Bacillus cereus	-	23	0	0

Based on the table above, metronidazole formed an inhibition zone that was smaller than the average of the three Ganoderma extracts against the growth of *Candida albicans*. This means that the ethanol extract of the three ganoderma species has greater ability to inhibit the growth of the test fungus.

The measurement results of the control inhibition zone diameter showed that ciprofloxacin (positive control) could inhibit the growth of gram-negative and gram-positive bacteria and had a very

strong inhibitory power, while aquadest and 50% DMSO (negative control) did not produce an inhibition zone..

4. Discussion

Before testing, each extract was made with a concentration of 20%, 40%, 60%, and 80% using distilled water for *Ganoderma applanatum* and *Ganoderma lucidum*, while the solvent used for *Ganoderma* sp. is Dimethyl Sulfoxide (DMSO) 50%. This is done because the thick extract from *Ganoderma* sp. cannot dissolve completely using distilled water. DMSO is used as a solvent for the negative control, because DMSO is a polar aprotic solvent, its boiling point is high so it evaporates slowly at the normal air pressure, a colorless solution that can dissolve polar and nonpolar compounds that have a wide range of organic solvents such as water and does not affect the biological activity of microbes [17].

The ability of the ethanol solvent to extract compounds contained in the three Ganoderma species is smaller than the ability of the ethanol solvent to extract compounds contained in other fungi. [18] obtained the yield of ethanol extract of black ear fungus (*Auricularia polytricha*) from maceration extract that was 14.77% by weight of 256.0011 gr of simplicia. In addition, [19] obtained a yield of 10.10% ethanol extract from 200 grams of white oyster mushroom simplicia analyzed. the research conducted by [20] obtained a yield of 13.08% or 143.93 grams of the weight of 1100 grams of simplicia.

The size of the yield value shows the effectiveness of the extraction process. The effectiveness of the extraction process is influenced by the type of solvent used as a solvent, the particle size of the simplicia, the method and duration of extraction [21] and the hardness of the simplicia particles. So it can be seen in table 3 that the three types of Ganoderma produce extracts with a yield percentage below 5%..

The thick ethanol extract obtained from maceration extraction is then tested to determine whether the ethanol extract has antimicrobial activity or not. The results showed that the three Ganoderma species had actimicrobial activity. The amount of antimicrobial activity increases with the increase in the concentration of ethanol extract given. This happens because at high concentrations, the active compound contained is more than the active compound contained in a solution with a lower concentration. Therefore, the higher concentration of inhibitory power is greater, and the concentration level of the extract with the greatest inhibition is the highest concentration, namely 80%. Research results by [22] also showed that the higher the concentration of *G. lucidum* extract, the higher the inhibition of *C. albicans* growth. This is in accordance with the opinion of [23] which states that the size of the inhibition zone is influenced by the sensitivity level of the test organism, culture media and incubation conditions, the diffusion rate of antimicrobial compounds and the concentration of antimicrobial compounds..

The three Ganoderma ethanol extracts were more effective against *Cryptococcus neoformans* than *Candida albicans*. This occurs because *Candida albicans* is one of the normal microbiota which is often exposed to chemicals (such as antibiotics) so that it mutates and has a physiological effect (for example removing compounds or which can neutralize anti-fungi so that it becomes resistant to some anti-fungal compounds) or has a morphological effect, such as forming a protective capsule in the form of a biofilm. Biofilms are fungi colonies that form an organic polymer matrix consisting of two layers, namely a thin basal layer which is the yeast layer itself, and the outer layer, namely the hyphae layer which is thicker but more tenuous in structure [24].

The ethanol extract from *Ganoderma lucidum* had greater antifungal activity against *Candida albicans* and *Cryptococcus neoformans* than the *Ganoderma applanatum* and *Ganoderma* sp. extracts. This is presumably because the active compound as an antifungal contained in *G. lucidum* has a higher amount than the other two Ganoderma fungi. This fungus has also been used for a long time as a medicine for various diseases. The results of this study are in line with the results of research by [25]

who showed that *G. lucidum* has antifungal activity against *Candida albicans, Aspergillus flavus, A. fumigates* dan *Crytococcus neoformans*.

From all of the above results, it is known that the three Ganoderma species are positive for anti-fungal compounds, where the antifungal compounds found in Ganoderma include terpenoids, flavonoids, tannins, alkaloids and steroids [25,26,27]. Research report presented by [28] that *Ganoderma lucidum* contains alkaloids, carbohydrate, saponins, protein, amino acids, phytosterols, fats, triterpenoids, flavonoids, phenolic compounds and tannins which might be used as antiinflammation, antibacteria, anticancer and antioxidants. These anti-fungal compounds work like antibiotics.

The mechanism of action of flavonoids in inhibiting the growth of fungi and bacteria is by causing disruption of the permeability of fungal cell membranes. The hydroxyl groups present in flavonoids cause changes in organic components and transport nutrients which in turn result in toxic effects on fungi [13].

Alkaloids can inhibit nucleic acid synthesis and affect ergosterol in fungi [29]. However, in [30] study, alkaloids had a negative effect on *Candida albicans* growth. Terpenoids can dissolve lipids in fungal cell membranes and interfere with nutrient transport which can cause the cell membrane to lack nutrients resulting in damage to fungal cells [29]. The mechanism of tannin inhibition is by affecting the integrity of the fungal cell walls so that electron transport is disrupted which results in inhibited fungal growth. In addition there is inhibition of fungal extracellular enzymes by tannins, fungi lose the substrate needed for growth and direct metabolic inhibition mechanisms through disturbance of oxidative phosphorylation or loss of Fe [31]. Tannins can also cause denaturation and coagulation of protein in bacterial and fungal cells, these derivatives can interact with microbial cells through an absorption process involving hydrogen bonds [32].

5. Conclusion

Ethanol extract of *Ganoderma lucidum, Ganoderma applanatum* and *Ganoderma* sp. has antimicrobial activity which inhibits the growth of *Candida albicans, Cryptococcus neoformans, Staphilococcus aureus, Bacillus cereus*, *Echerichia coli,* and *Shigella* sp.. *G. lucidum* showed that the antimicrobial activity was highest against *C. albicans, C. neoformans* and *B. cereus* compared to *G. applanatum* and *Ganoderma* sp.. *Ganoderma* sp. had the highest inhibitory activity against the growth of *Shigella* sp. and *B. cereus*., but the weakest against *S. Aureus*. While *G. applanatum* had the weakest inhibitory activity against the growth of the tested microbes, be it fungi, gram-negative bacteria and gram-positive bacteria. Extract concentration is directly proportional to the amount of inhibition zone formed. This study justifies the claimed uses of *Ganoderma* in the traditional system of medicine and its bioactive components to treat various infectious diseases caused by the microbes.

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