

# CHAPTER I

## PRELIMINARY

### 1.1. Background

Cayenne pepper (*Capsicum frutescens* L.) is one of the important vegetable commodities in Indonesia. Generally, many people use the fruit of the cayenne pepper plant as a cooking spice, fresh vegetables and therapy for health. This is because cayenne pepper contains a lot of sufficient nutrients such as fat, protein, carbohydrates, calcium, iron, vitamins that are useful in improving the taste of cooking, increasing appetite, and beneficial in the health sector such as pain relief, smoothing the respiratory tract. and detoxification (Sujitno & Dianawati, 2015).

Many benefits that can be obtained from cayenne pepper can affect the increase in market demand for cayenne pepper needs, but the large market demand for chili needs is not supported by large cayenne pepper production, several factors cause this according to Sholehah (2012) cayenne pepper plants as one of the vegetable crops that are susceptible to various pests and diseases so that it can inhibit the physiological function of plants and reduce the productivity of cayenne pepper.

Some of the diseases that occur in cayenne pepper are Fusarium wilt disease, anthracnose fruit rot and jaundice, diseases that occur in plants can be caused by pathogens such as bacteria, viruses, and fungi. One type of pathogen that attacks

cayenne pepper plants can be caused by the fungus *Colletotrichum* sp, a plant disease caused by this fungus is called anthracnose disease.

Anthracnose is a disease that can attack any part of the plant with a fairly high destructive power and transmission is very fast with symptoms of this disease, namely, continuous shoot death, dry twigs and branches blackish brown and there are protrusions on the stems of the plant so that if not treated properly, it has the potential to reduce the productivity of cayenne pepper so that it is detrimental to the commodity of cayenne pepper farmers (Herwidyati et al, 2013)..

Efforts that can be made to control plant diseases generally use chemical pesticides/fungicides, fungicides are chemicals or other materials that are toxic and not environmentally friendly which are used to control plant pests and diseases. Then commodity farmers need to reduce these activities and switch to natural fungicides that are environmentally friendly as well as non-toxic and can be done alone so that they can save production costs, natural fungicides are a better solution to replace synthetic fungicides. Natural fungicides can be obtained from natural ingredients with secondary metabolite compounds produced by plants.

The use of natural fungicides that have been made are from extracts of the pyrethrum plant (*Tanacetum cinerariifolium*), Rotenon (*Derris* sp.), Azardiakta (*Azadirachta indica*), essential oils from the Rosemary plant (*Rosmarinus officinale*, Eucalyptus (*Eucalyptus globus*), Clove (*Syzygium aromatic*), Thyme (*Thymus vulgaris*), mint (*Mentha* sp.), Tobacco (*Nicotiana* sp.), some of the above plants have compounds that are effective against fungal pests *Colletotrichum* sp and other plant pathogenic diseases (Supriadi, 2013).

In addition, the use of natural fungicides can be made from different types of plants such as from avocado seeds which have some of the same compound content with those of the plants mentioned above (Yachya & Sulistyowati, 2015) but avocado seeds become organic waste which has been disposed become unutilized waste.

Then in order to overcome both problems above, avocado seed waste is an alternative that can be used as a natural fungicide that has the potential to inhibit the growth of the *Colletotrichum* fungus which causes losses for chili farmers commodities and helps reduce the productivity of avocado seed organic waste contamination in the environment.

Natural fungicides from avocado seeds have the following advantages including availability of abundant and easy-to-obtain raw materials, according to research by Yachya & Sulistyowati (2015) avocado seeds have great benefits can be obtained from the seed compound, some of its compounds such as alkaloids, flavonoids and terpenoids were proved to have potential as antifungals. .

Based on previous research on the inhibition test of avocado seed ethanol extract as an anti-microorganism on different types of pathogens such as *Streptococcus mutans*, *Aerobacter aerogenes*, *Proteus mirabilis* (Yachya & Sulistyowati, 2015), *Artemia salina* and *Candida albican* (Julianto, 2015).

Then from the previous research data on the inhibition test against microorganisms, the researcher conducts a growth inhibition test for the fungus *Colletotrichum* sp. to know the cause of disease in cayenne pepper that has harmed farmers.

## **1.2 Formulation of the problem**

Based on the above background, the formulation of the problem in this study is whether the ethanol extract of avocado seeds has the potential as an antifungal and what is the optimal concentration of avocado seed extract that can inhibit the growth of the *Colletotrichum* sp fungus.

## **1.3 Objectives**

This study aims to determine the potential of avocado seed extract as an antifungal and the optimum concentration of avocado seed extract in inhibiting the growth of the *Colletotrichum* sp fungus.

## **1.4 Benefit**

The benefit of this research is to provide scientific information about the activity of giving natural pesticides that can inhibit the growth of the *Colletotrichum* sp. fungus as chili anthracnose.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.1 Description of Avocado Plant (*Persea americana*).**

Avocado is a plant originating from Central America with a tropical climate and has spread throughout tropical and sub-tropical countries, one of which is Indonesia. Almost all Indonesian people know the avocado plant and like the fruit (Yachya and Sulistyowati, 2015).

According to Van Steenis (1997), the scientific classification of avocado plants is as follows: Kindom: Plantae. Division: Sepermatophyta. Class: Dicotyledoneae. Order: Laurales. Family: Lauraceae. Genus: *Persea*. Species: *Persea americana* Mill.

##### **2.1.1 Avocado Plant Morphology**

The morphology of the avocado plant starting from the root system is, avocado is a plant with a single root system where the roots have a length of 5-10 m. These roots have a function like roots in other plants, namely absorbing water and nutrients from the soil and these roots can function to support the avocado plant's body so that it can stand upright (Felistiani, 2017).

The stem of the avocado plant has a round and elongated appearance with sizes of 5-10 m, the stem of this plant is classified as a hard wood trunk and covered with hard bark, this stem is brown and has many branches on its branches (Abubakar, 2014).

The leaves of this plant have a leaf system with a single leaf appearance, green to reddish in color, round to oval in shape. It has flat leaf edges and rolls up, 10-20 cm long with 3-10 cm wide, smooth surface and leaves of avocado plants have pinnate spines (Felistiani, 2017).

The flower on the avocado plant is, the avocado has compound flowers with multiple sexes. The appearance of the avocado plant flower is like a star, has a yellow to green color. Flowers are found in the axils of the leaves or on the inner twigs, flower pollination can be assisted by several factors, both biotic and abiotic factors, where biotic factors in the flower pollination process in avocado plants assisted by insects or animals that are around the flower while abiotic factors in the pollination process can be assisted by the wind factor (Felistiani, 2017).

Avocado is very well known for its fruit which has many benefits, where the fruit of this plant has an oval shape or irregular shape and having a size of up to 10-20 cm, avocado fruit has a greenish to yellowish red color, on the surface of the outer skin of the avocado it has purple spots, avocados have thick flesh with dark yellow blight green color (Pradita, 2017).

Avocado seeds are single seeds which generally white in shape, ovoid to oval, with a diameter of 2.5-5 cm, avocado seeds are sprouts of the avocado plant where if these seeds fall on good and fertile's soil conditions, the seeds will be able to grow to be a new avocado plant (Yachya & Sulistyowati, 2015)

### **2.1.2 Content of Avocado Seeds**

Avocado seeds have many benefits that can be taken from the compound content of the seeds. It is known that avocado seeds contain phytosterols, triterpenoids, fatty acids, abscisic acid, furanoic acid, flavonoid dimers and proanthocyanidins, according to research by Yachya & Sulistyowati (2015). The following compounds have been shown to have potential as antifungals.

Based on the results of research by Abubakar et al (2014) who isolated the active compound of ethanol extract in avocado seeds. Followed by doing a phytochemical test, obtained the results of the active compound in the avocado seeds ethanol extract, namely are from the triterpenoid group marked by a color test with Lieber-Buchard reagents showing a positive reaction on terpenoids with a purple color.

Terpenoids are compounds produced from secondary metabolites of plants that can inhibit the growth of microorganisms, one of which serves as antibacterial (Gunawan et al, 2015).

According to Diana (2016), flavonoid compounds are polyphenol group compounds that function as antifungals, these compounds are often used as antifungals because these compounds have the property of damaging fungal cell membranes so that they can cause changes in the permeability of these cells. If flavonoid compounds enter into fungal cells, these compounds will result in a

process of inhibiting growth in fungal cells.

## **2.2. Description of Cayenne Pepper (*Capsicum frutescens* L.).**

Cayenne pepper (*Capsicum frutescens* L.) is one of the horticultural plants that the people of Indonesia very much favor, this is because the fruit of cayenne pepper is often used as a mixture of processed spices for cooking or used as a medicinal plant. Cayenne pepper with a spicy taste can trigger an appetite reaction, so this fruit is often used as a complementary ingredient in cooking. Besides that, cayenne pepper contains sufficient nutrients, including fat, protein, carbohydrates, calcium, phosphorus, iron, vitamins A, B1, B2, C and alkaloid compounds (Sujitno & Dianawaty, 2015).

Chili plant is one of the plants with high economic value because chili is a spice plant that is widely used as a processed ingredient combined by several dishes. In addition, chili is also used as a traditional medicinal plant such as a stimulant to relieve stomach pain, backache, headaches and rheumatism. According to Van Steenis (1997), the scientific classification of cayenne pepper plants is Kingdom: Plantae. Division: Spermatophyta. Classes : Dicotyledone. Order: Solanales. Family : Solanaceae. Genus: *Capsicum*. Species : *Capsicum frutescens* L.



### **2.2.1 Cayenne Pepper Plant Morphology**

The morphology of the chili plant starts from its roots, where the roots of the cayenne pepper plant are strong taproots and branching to the side and form root hairs (fiber roots), these fibrous roots can penetrate the soil up to 50 cm. (Utami, 2018).

The stem of the cayenne pepper plant is the main woody stem, the formation of woody stems in this plant starting from the age of the plant to 30 days, with a height of 30-37.5 cm with a diameter between 1.5 - 3 cm. The stem of the cayenne pepper plant has a greenish-brown color, while the leaves on the cayenne pepper plant are light green to dark green, pinnate spines with tapered leaf tips (Arifin, 2010).

In general, the Solanaceae tribe is shaped like a trumpet (*Hypocrateriformis*) including full flowers having petals (*Calyx*), *Corolla* , stamens for male sex on medium plants and pistil (*Pistilium*) for female sex on chili plants. In 1 pistil consists of 6 stamens, the color are white with purple anthers, at the time of the formation of the chili fruit the flower crown will fall off but the presence of the flower petals will remain and stick to the chili fruit (Arifin, 2010).

### **2.2.2. Problems with Chili Plants**

Cayenne pepper is a plant that has many factors that cause failure or damage

to post-harvest of this plant, several factors that cause failure during the growth and development of this plant can be divided into two, these factors can be divided into two factors, namely, environmental factors and biological factors. Environmental factors are influenced by drought and flooding, while biological factors can be caused by bacteria, viruses or fungi (Sulastri et al., 2014).

Several types of pathogenic fungi that cause disease in chili plants include *Colletotrichum capsici*, *Gloesporium piperatum*. This anthrax does not only attack chilies but also other plant parts (Setiadi, 1993).

Several types of chili plant diseases that arise include leaf spot, anthracnose disease, flour disease, root neck rot disease, fusarium wilt disease and art fall disease (Suwardani et al., 2014).

### **2.3 Description of *Colletotrichum* sp.**

*Colletotrichum* sp. is a type of fungus that causes anthracnose disease. This fungus is the largest plant-disturbing organism (OPT) that is often found in chili plants. This disease can decrease the quality and quantity of cayenne pepper, which is characterized by early symptoms such as blackish brown spots that expand and become soft and rotten. This disease is capable of infecting all chilies, it will cause great damage to cayenne pepper, both easy fruit and ripe fruit. If these

pests are not handled, they will cause considerable economic losses for farmers and the community. This is in accordance with (Hersanti et al, 2015) which states that anthracnose disease that occurs in chili plants can cause losses of up to 60% even if proper control is not carried out to overcome the problem, the losses that can be experienced will increase to an amount of 100%.

According to Alexopoulos and Mims (1996) the scientific classification of fungi *Colletotrichum* sp are: Kingdom: Fungi. Division: Ascomycota. Class: Ascomycetes. Ordo: Melanconiales. Family: Melanconiaceae. Genus : *Colletotrichum*. Species: *Colletotrichum* sp.

### **2.3.1. *Colletotrichum* sp . Fungus Morphology**

The morphology of the fungus *Colletotrichum* sp is a single-celled fungus with a size of 5-15  $\mu\text{m}$ , this fungus has cylindrical spores with dark, non-insulated hyphae, short conidia shaped like a hyaline crescent moon and not insulated 10 unbranched conidiophores. (Sulastri et al. 2014) this fungus has an oval-shaped appressorium, which appressorium has a function in helping the process of hyphae penetration into the infected plant tissue. The next stage of the fungus will produce several enzymes including Protease, Cellulase and Pectinase enzymes. The

enzymes produced by the fungus *Colletotrichum* sp can cause damage to the structure of plant cell walls. The genus *Colletotrichum* causes several types of diseases such as leaf wilt, anthracnose, red rot, and rot disease in strawberries, bananas, and coffee cherries. Several species of the genus *Colletotrichum* according to Utami, (2018), namely, *Colletotrichum gloeosporioides*, *C. acuatum*, *C. dematium*, *C. capsici*, *C. truncatum*, *C. coccodes*.

The life cycle of the fungus *Colletotrichum* sp can infect chili plants in the early stages of the conidia found on the surface of the cayenne pepper plant that will produce a sprout tube, after the sprout tube penetrates the epidermis layer of the chili fruit skin then it will form a network of hyphae, then intra and intercellular hyphae enter and spread throughout the plant tissue, the spread of spores of the fungus *Colletotrichum* sp can be through many factors, one of which is abiotic factors such as rainwater, so that when the spores are in a suitable host, then the spores will develop well. (Ningtyas, 2013).

### **2.3.2. Symptoms of Diseases Due to Fungal Attack of *Colletotrichum* sp.**

In general, the symptoms that arise due to this fungal attack are usually marked with spots, if on fruit, both young fruit and old fruit, these spots will gradually widen until in the end all parts of the sump will be filled with these spots and sooner or later the fruit will shrivel, dry up, the color of the fruit turns blackish

and rotten, and so on it will fall by itself and it is very worrying condition (Setiadi, 1993).

According to Utami (2018), the initial symptoms that arise due to infection with the fungus *Colletotrichum* sp. in the form of small black spots, further attacks will cause withering, shrinking, drying, rotting and falling. If the seeds carry the attack at the nursery time, it can cause failure and wilt and attack on mature plants is indicated by the symptoms that arise in the form of dead shoots, rot and dryness on the leaves and stems of the plant. The severity of anthracnose attack during the rainy season where the damage may causes yield failure of 50-100% .

#### **2.4 Antifungal and History of Biological Control**

Antifungal, also known as antifungal, is a class of drugs or compounds that are fungicides in inhibiting fungal growth and curing various diseases caused by fungi (Christoper et al., 2017).

The beginning of the history of biological control when Atkinson discovered a diversity of severity of Fusarium wilt disease in 1892 which was known to be affected by soil, and then Potter in 1908 found the presence of inhibitory pathogens in its metabolites which at that time were not known the pathogen name and subsequently in 1926 Sanford discovered that green manure could potentially treat potato scabies. Since then, biological control has emerged

with two concepts, namely the first, the saprophytic microbes can control the malignancy of plant pathogens, and second, the balance of microbes in the soil may change, especially by changes in soil conditions, therefore the addition of fresh organic matter is required (Soesanto, 2008).

## **2.5 Fungicides and Their Types**

Fungicides are chemicals or other materials that are generally used to control or inhibit specific pests such as disease-causing fungi (Ariyanti et al, 2017).

Generally, fungicides are divided into two types, namely synthetic or chemical fungicides and biological or natural fungicides, usually farmers use synthetic fungicides to control pests and various plant diseases, but these fungicides have disadvantages, besides being expensive, these fungicides also have an environmentally unfriendly effect. so that it causes damage to plants as well as the surrounding environment and chemical compounds from these fungicides will stick to vegetables, if these compounds are consumed with vegetables, then we will eat vegetables with compounds that have toxic properties that can cause various diseases including degenerative diseases such as cancer. (Astuti & Widiastuti, 2016).

Fungicides have a role in improving the quality of production for

agricultural commodities, the use of pesticides on agricultural land brings benefits to farmers, this can be seen from increasing crop production, reducing pests and diseases in plants (OPT), ensure the supply of food reserves due to increased yields and improve the quality of plants and the environment. (Supriadi, 2013).

### **2.5.1 Synthetic Fungicides**

Synthetic fungicides are active compounds with toxic ingredients and are difficult to degrade in nature. This type of fungicide can cause damage to the environment, such as environmental pollution, decreased populations of organisms that act as integrated natural biological controllers, and loss of biological diversity as well as causing new pests (OPT) that can be resistant to Synthetic fungicides (Supriadi,2013).

### **2.5.2 Natural Fungicides**

Natural fungicides are a type of drug class taken from natural ingredients such as plants that produce secondary metabolites compounds among their compound contents such as alkaloids, carpins and flavonoids. This compound has toxic properties for plant growth and pests so that the bioactive compounds exist in these plants can inhibit the activity of plant pests (Ariyanti et al, 2017).

## **2.6 Antifungal Analysis.**

Some of the methods commonly used in antifungal analysis include a). Conidia Germination Method, b). Cross scratch method, and c). jelly diffusion method, which this method can be divided into two methods, the first method is the well diffusion method, and the second method is the disc method and the next method is d) Poison food method, this method is carried out to determine the inhibition of fungal growth by determining the size of the diameter of the fungus (Wahyuni et al, 2014).

Poison food method also has advantages and disadvantages in how to use them, including: The use of this method can be determined by factors in incubation time, preincubation, pre-diffusion, inoculum and media thickness, if these factors are not appropriate then the results of the disc method will be difficult to interpret, apart from that the shortcomings of the disc method generally cannot be applied to microorganisms that very slow growth. The advantages of using this method are that it is easy to do, does not require special equipment, and uses simple and relatively cheaper materials and tools (Yulia et al, 2016).



## **CHAPTER III**

### **RESEARCH METHODS**

#### **3.1 Time and Place of Research**

This research was conducted from January to March 2019 in Plant Protection Laboratory, Faculty of Agriculture, Medan University Area.

#### **3.2 Research Tools and Materials**

The tools used in this research consist of: Knife, Pot, Analytical balance, Beaker glass, Measuring glass, Erlenmeyer flask, Volume measuring pipette, Ball pipette, Funnel, Petris dish, Water bath, Oven, Incubator. Vacuum Rotatory Evaporator. Calipers. Cork drill.

The materials used in this study were: Avocado seeds, cayenne pepper infected with *Colletotrichum* sp, PDA (*Potato Dextrose Agar*), Ethanol 70%, Distilled water, Topsin M 70 WP 0.2% Fungicide.

#### **3.3 Research Method**

The method used in this study is a laboratory-scale experimental method. The data obtained will be analyzed using the Factorial Completely Randomized Design (CRD) method. The research observations are divided into two variables, namely; 1) The independent variable is the variation of the concentration of the avocado seed ethanol extract and 2) The dependent variable is the diameter of the growth of the *Colletotrichum* fungus.

### **3.3.1 Research Procedure**

As for the working procedure of this research consists of five stages where the stages are; 1) Sample preparation, 2) Provide crude extract of avocado seeds, 3) Providing crude extract of avocado seeds with various concentrations, 4) Making the isolation of the fungus *Colletotrichum* sp. 5) Conducting the inhibition test process of avocado seed ethanol extract against the growth of the fungus *Colletotrichum* sp.

#### **1. Sample Preparation**

Sample preparation was carried out in two stages; 1) The sampling technique of cayenne pepper and 2) the technique of making avocado seed simplicial. The process starts from taking a sample of cayenne pepper that is suspected to be infected with a fungus *Colletotrichum* sp was carried out randomly on cayenne pepper plants in Tongkoh Village, Karo Regency, North Sumatra by using tools such as gloves, scissors, tissue, sample cups, followed by sorting avocado seeds and then washed clean, sliced into small pieces to reduce the area, seeds then dried to 10% water weight in an oven at a temperature of 50-70°C for 24 hours and grinded until become avocado seed powder simplicial and then the simplicial was filtered using a sieve.

#### **2. Preparation of Avocado Seed Coarse Extract**

Extraction is done by Maceration (Soaking) method. Avocado seed powder simplicial (*Persea Americana* Mill.) was weighed as much as 300 grams and then soaked in ethanol as much as ( $\pm 1.2$  l) or ratio (1:4). The weighed sample was put

into a reagent bottle, then filled with ethanol until all samples were submerged and then homogenized. For 1x24 hours the solvent is added and then stirred until mixed, this is done until it reaches the limit of 3x24 hours, then the resulted ethanol extract can be evaporated using a Vacuum Rotatory Evaporator / Waterbath (Abubakar, 2014), at a temperature of (50-60°C) with a rotational speed of 50-60 rpm) pressure of (150-200 mm Hg) to obtain a crude avocado seed extract then to make an extract with a concentration of 100%, the concentrated extract was made using distilled water with a ratio of 1:1 (w/v) (Pranata, 2018).).

### **3. Provision of Avocado Seed Crude Extract with Various Concentration**

The results of the extraction of avocado seeds in various concentrations in the treatment of making 100 ml of jelly media are obtained in the following way (Pandalas, 2018).

K<sub>0</sub>: Positive Control = 100 ml distilled water + 4 gm PDA

K<sub>1</sub>: PDA Negative Control = 100 ml distilled water + Fungicide 0.2 % + 4 gm PDA

K<sub>2</sub>: 20 ml avocado seed extract + 80 Distilled water + 4 gm PDA

K<sub>3</sub>: 40 ml avocado seed extract + 60 Distilled water + 4 gm PDA

K<sub>4</sub>: 60 ml avocado seed extract + 40 Distilled water + 4 gm PDA

K<sub>5</sub>: 80 ml avocado seed extract + 20 Distilled water + 4 gm PDA

K<sub>6</sub>: 100 ml avocado seed extract + 4 gm PDA

### **4. Isolation and Identification of Fungus *Colletotrichum* sp.**

This process consists of four stages; 1) Preparation of PDA media is carried out by taking 10 grams of PDA + 3 grams of swallow agar + 200 ml of distilled water mixed until homogeneous, the process is continued by cooking the media at a temperature of 50-60<sup>0</sup>C , furthermore it is cooled for ± 10 minutes after that it is continued by media sterilization process with autoclav at temperature of 121<sup>0</sup>C for 15 minutes with air pressure 0.5 MPa. 2) Fungal inoculation was carried out by the Direct plating method, this process was carried out by cutting the infected fruit with a size of 2x2 mm, then the cutted part was dipped in 70% alcohol to remove contamination on the outside, after that it was rinsed with distilled water 3 times. Furthermore, the part was placed on the surface of the PDA media and incubated for 2 x 24 hours at room temperature 28<sup>0</sup>C 3) Identification is done by taking the fungus on the growth medium using a needle loop and then scratching it on the surface of the glass object and given 1 drop of distilled water and then viewing it on a microscope with a lens magnification of 20-40x. 4) The fungus that grows is then isolated on a new PDA medium and then incubated at 28 for 5x24 hours (the best time to harvest mushrooms) (Utami, 2018).

## **5 Inhibition Test of Avocado Seed Ethanol Extract against The Growth of Fungal *Colletotrichum sp.***

The antifungal activity test with avocado seed extract was carried out using the Poison food method (Yulia et al, 2016) in order to determine the diameter of the growth of colonies on the test media. This process begins with the provision of test media, namely Treatment (positive control, negative control and extract

concentration) + PDA that has been provided, the control (+) is homogenized with distilled water, while the control (-) is given the synthetic fungicide Topsin M 70 WP 02% while the treatment was given extract according to the specified concentration, namely 20%, 30%, 40%, 60% and 100%. The next process is to insert the test media into a sterile petri dish as much as  $\pm 10$  ml then wait until cold and solid. The purified fungus *Colletotrichum* sp is taken using a 0.5 mm cork drill then placed in the center of the media, observations on colony diameter were carried out at intervals of 3x24 hours Day after incubation or Hsi (4 Hsi, 5 Hsi, 6 Hsi, 7 Hsi, 8 Hsi).

### **3.4. Data Analysis**

The data obtained were observed using the factorial RAL (completely randomized design) method. They will be analyzed using Analysis of Variance (ANOVA) with a 95% confidence level to determine the effect of giving avocado seed ethanol extract on the growth of the fungus *Colletotrichum* sp. Then the data obtained was continued with the post-hoc least significant difference (LSD) test with a significance level of 5% to determine the significant difference between the 2 treatment groups with extract concentrations and other extract concentrations. In this research, there were 7 treatments of the test solution with 5 different days of observation and given 3 replications, respectively. Then the treatment can be calculated  $7 \times 5 \times 3 = 105$ . The forms of the 105 treatments are showed in Table 1.

**Table 1. Inhibitory Test of Avocado Seed Ethanol Extract against *Colletotrichum.sp***

DOSE	TREATMENT DAY	Repetition (Mm)
WITHOUT EXTRACT		

Treatment                      Repetition (mm)                      Mean  
Dose                      Day

H8

## **CHAPTER V**

### **CONCLUSIONS AND SUGGESTIONS**

#### **5.1 CONCLUSION**

Based on the research results, it was concluded that the ethanol extract of avocado seeds showed effective and significant results in inhibiting the growth of the *Colletotrichum* fungus. This is evidenced from the concentration of ethanol extract of avocado seeds 40% which is the optimal concentration treatment to provide antifungal effects on the activity of the fungus *Colletotrichum*.

#### **5.2 SUGGESTIONS**

Further research is needed on antifungal analysis of avocado seed ethanol extract in inhibiting the growth of different types of fungal diseases in cayenne pepper. (*Capsicum frutescens*).



## PROOFREADING

1.	including complete flowers	:	including full flowers
2.	for the purpose of controlling	:	to control
3.	that have secondary metabolite compounds that can be	:	with secondary metabolite compounds
4.	The objective of this study is	:	This study aims
5.	that have the potential to inhibit	:	that can inhibit
6.	have the potential to	:	can
7.	is very much favored by the people of Indonesia	:	the people of Indonesia very much favor
8.	is able to give the effect of decreasing	:	can decrease
9.	the attack at the time of the nursery is carried by the seeds	:	the seeds carry the attack at the nursery time
10.	generally used for the purpose of controlling or inhibiting	:	are generally used to control or inhibit
11.	that the test media is inserted	:	to insert the test media
12.	results of the research	:	research results
13.	this was influenced by a fairly small pressure concentration	:	a fairly small pressure concentration influenced this
14.	secondary metabolites contained in avocado	:	secondary metabolites in avocado
15.	in an easy and inexpensive way	:	easily and inexpensively
16.	it is possible for farmers to work	:	farmers can work
17.	have no effect on	:	not affect
18.	proves that there is a linear	:	proves a linear
19.	find out	:	determine
20.	that can disrupt	:	that disrupt
21.	alternative in an effort to eradicate	:	alternative to eradicate