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Potential Antioxidant Content of Three Types of Mimosa Weed from Various Plant Parts using The DDPH (2,2-diphenyl-1-picrylhydrazyl) Method

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Abstract

Antioxidants are essential for neutralizing free radical and their presence in plants like mimosa weeds could be beneficial for various applications, include medical uses and agricultural development. This research focus on the potential antioxidant content of mimosa weed species (*Mimosa pudica* L., *Mimosa invisa* L., *Mimosa pigra* L.) from various plant parts (roots, stems, leaves and seed) using the DPPH method (2,2-diphenyl-1-picrylhydrazyl). This study aims to understand the interaction between different types of mimosa weeds and various plant parts in relation to antioxidant activity levels, as well as phytochemical content across the three types of Mimosa sp. using the DPPH method and determine the best-performing weed and plant parts based on the smallest IC50 value and highest phytochemical content. This research was conducted in Padang City. Sample drying and extraction were carried out at the Plant Physiology Laboratory, Faculty of Agriculture, Andalas University, and phytochemical tests were performed at Vahana Scientific Laboratory Padang. The research took place from February to May 2024. The design used was a factorial Completely Randomize Design (CRD). The first factor is the treatment of Mimosa sp. weed species, namely: *Mimosa pudica* L., *Mimosa invisa* L. and *Mimosa pigra* L. The second factor was the treatment of different parts of the Mimosa sp. Namely: root, stem, leaf and seed. From these two factors, 12 treatment combinations were obtained, each repeated three times, resulting in a total of 36 experimental units. The research data were analyzed statistically with the F test at the 5% level and if F count > F table at 5%, then it continued with Duncan's New Multiple Range Test (DNMRT) at the 5% level. The results showed that there was an interaction between mimosa weed species and plant parts in terms of antioxidant activity, as indicated by the IC50 values. The strongest antioxidant was found in the leaves of *Mimosa pigra* L., with an antioxidant value of 41.89 mg/L.

Keywords: Antioxidant activity, DPPH assay, IC_{50}, Mimosa species, Phytochemical screening

1. Introduction

Weeds are plants that grow wild in uninhabited places. desired or in unplanted areas. Weeds can grow quickly and spreads easily because it has good adaptability to different environments and are generally detrimental because they can hinder plant growth and development, thus reducing the quality and quantity of crop yields (Paiman, 2020). However, on the other hand, several types of weeds have positive value, including being able to function as a medicinal plant. Herbal plants are the plants that can be utilized as an alternative for natural disease treatment. The parts of the plants used may include roots, stems, leaves, tubers, or even the entire plant. The use of traditional medicine has been practiced for thousands of years, long before modern medicine was discovered and marketed. However, in reality, the existence of medical plant cannot yet be equated with modern medical service because of their safety and efficacy have not been fully tested. Most of the benefits and development of medical plant are base solely on empirical data and experiences passed down from generation to generation (Febrianti et al., 2022).

The use of medicinal plants traditionally is considered safer for used when compared to modern medicines on the market, because, it is natural and does not contain any

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dangerous chemicals, so it has consequences of smaller results compared to modern medicine and also easily obtained in the surrounding environment. According to Vera & Yanti (2020), health maintenance and disease prevention by utilizing herbs very necessary and must be developed especially with the soaring costs treatment in the present day. One of the weeds that is often encountered by the community, namely the mimosa weed which has many health benefits such as antioxidant, antidiabetic and wound healing (Azmi, Singh & Akhtar, 2011). Therefore, knowledge about the benefits of this type of other mimosa weeds need to be developed.

The mimosa plant (*Mimosa sp*.) is a type of plant that attracts attention because of its unique nature of being able to close its leaves when touched and will reopen after a few minutes after being touched. Mimosa weed can be found on the roadside and reproduces quickly (Dalimartha, 2008). The *Mimosa pudica* L. plant contains alkaloids, glycosides, flavonoids, and tannins which are efficacious as a source of drugs (Zhang, Yuan, Zhou, Zhou, & Yang, 2011). Based on research conducted by Patro, Bhattasamisra, Mohanty, and Sahoo (2016), mimosa weed has antioxidant potential based on antioxidant activity tests that have been carried out carried out, namely IC50 46.06 mg/mL which is included in the strong antioxidant category.

The mimosa plant, or *Mimosa invisa* L., belongs to the Fabaceae family. which is a close relative of *Mimosa pudica* L. and is often referred to as the princess great shame (Uluputty, 2014). The chemical content of this plant is a compound mimosine, pipecolinic acid, tannins, alkaloids, saponins, triterpenoids, sterols, polyphenols, flavonoids, proteins and steroids (Kalabharathi et al., 2015; Rajendran and

Krishnakumar, 2010; Ranjan et al., (2013). Results of phytochemical tests on simple and extract *Mimosa pudica* L. herb shows the presence of mimosine, tannin, flavonoids, alkaloids, saponins, polyphenols, monoterpenoids, sesquiternoids, steroids and Quinone. *Mimosa pudica* L. leaf extract is known to increase antioxidant enzymes. such as Superoxide Dismutase (SOD), Catalase and Glutathione Peroxidase (Rini et al., 2013).

Mimosa pigra L. or giant mimosa weed is a plant that comes from South America. This weed is a type of plant that grows in tropical and subtropical areas. This giant mimosa weed is able to grow so that the height of 3 meters in the bushes and damp places, has the same body structure as the *Mimosa pudica* L. plant. *Mimosa pudica* L. plant This giant grows in open or sheltered areas at a height of up to 1000 m above sea level. This weed also has several health benefits namely as a medicinal plant because it contains several compounds that are efficacious as a medicine such as the content of Flavonoid, Tannin, Alkaloid compounds. These compounds have properties as anti-inflammatory, antibacterial, antiseptic. This mimosa weed can also be used to treat various diseases include fever, headache, muscle pain, inflammation, infection (Uluputty, 2014).

Antioxidants are compounds that can contribute to one or more electrons to free radicals, so that free radicals can be stabilized, and the process continuous oxidation can be stopped. The human body is naturally capable of producing antioxidants, such as glutathione peroxidase, superoxide dismutase and gluation s-transferase (Ramdani et al., 2013). Antioxidants are compounds which can help humans protect their bodies from free radical attacks. which causes various dangerous diseases and can damage various macromolecules cells, including proteins, nucleic acids, fats and carbohydrates. Research also shows that consuming antioxidants can cure various diseases and can reduce the risk of contracting heart disease, cancer, and cataracts (Yuhernita, 2011). Based on several research that has been conducted shows that antioxidants from every part of the plant have different activities as reported by Amatya (2011) that the ethanol extract from the E. odoratum plant (another name for Chromoleana odorata) has the following inhibition sequence: Flowers (which have fat removed) > Leaves > Roots 2 > Stems. With an inhibitory power of 87.93% in leaves, 91.05% in flowers, 31.25% in roots and 7.59% in stems.

The commonly used antioxidant activity test is the method DPPH (2,2-diphenyl-1- picrylhydrazyl). Yuhernita (2011) also explained that DPPH with a purple color is a radical. free and will produce a yellow color when reacted with antioxidants and form stable compounds. DPPH also has advantages including stable at room temperature and easy to store even for long periods of time, also shows a color change that is easily observed. Therefore, in This study was conducted to test the antioxidant activity of stem and root extracts. with the DPPH method (Yuhernita 2011).

2. Material and Methods

The experiment began with sampling test weeds in the Tanjung Barulak village, Tanah Datar District, then for the drying process and sample extraction was carried out at the Plant Physiology Laboratory, Faculty of Agriculture Department of Andalas University with coordinates 0°54'43" S 100°27'35" E and for antioxidant activity testing, phytochemistry was carried out at Vahana Scientific Padang Laboratory with coordinates 0°53'46" S 100°22'14" E. The altitude of the research location is ± 200 meters above sea level. This research conducted in February-May 2024.

The materials used are 3 types of mimosa weed with other names. *Mimosa pudica* L., *Mimosa invisa* L., *Mimosa pigra* L., running water, distilled water and some chemicals used in this study such as DPPH (2,2-diphenyl-1-picrylhydrazyl), methanol (CH_3OH), ethanol 96% (C_2H_6O), HCl, Mg powder, H_2SO_4, acetic anhydride, meyer, dragendorff, $FeCl_3$, tissue and aluminum foil.

The equipment used in this experiment is a UV-Vis spectrophotometer. (Hitachi), rotary vacuum booster or rotary evaporator Buchi (Heildold Laboratories 4000), oven, micropipette (Dragonlab), grinder, drip pipe, filter paper, rod stirrer, test tube, vortex (DLAB vortex mixer MX-S), analytical balance (analytical balance fujitsu), grinder, 350 ml glass bottle, glass bottle 10 ml size, measuring flask, measuring cup, test tube, blender, funnel, mobile phone and stationery.

The design used in this experiment was a Randomized Design Complete (RAL) factorial consisting of 2 factors. The first factor is treatment of *Mimosa sp*. types consisting of 3 levels treatment. The second factor is the treatment of the plant parts of the mimosa weed. consisting of 4 levels of treatment from the two treatment factors, 12 were obtained treatment combinations were repeated 3 times so there were 36 in total experimental unit. The implementation of the research is presented in the following flow diagram:

Sampling of mimosa weeds is based on the characteristics of each plant. each of the three types of *Mimosa pudica* L. sugar. The samples used in this study there were 36 samples from 12 treatment levels and 3 replications. Treatment given There are 3 types of mimosa weed and 4 plant parts of mimosa weed in the form of seeds, roots, stems and leaves.

Samples of each weed obtained were washed thoroughly to remove soil carried from the field and other dirt. Then the samples were air-dried for seven days so that the weeds would dry naturally. maximum with fragile texture characteristics. Then the mimosa weed which already dry cut, weigh and separate the types of mimosa weed and the parts- weed section and label according to treatment.

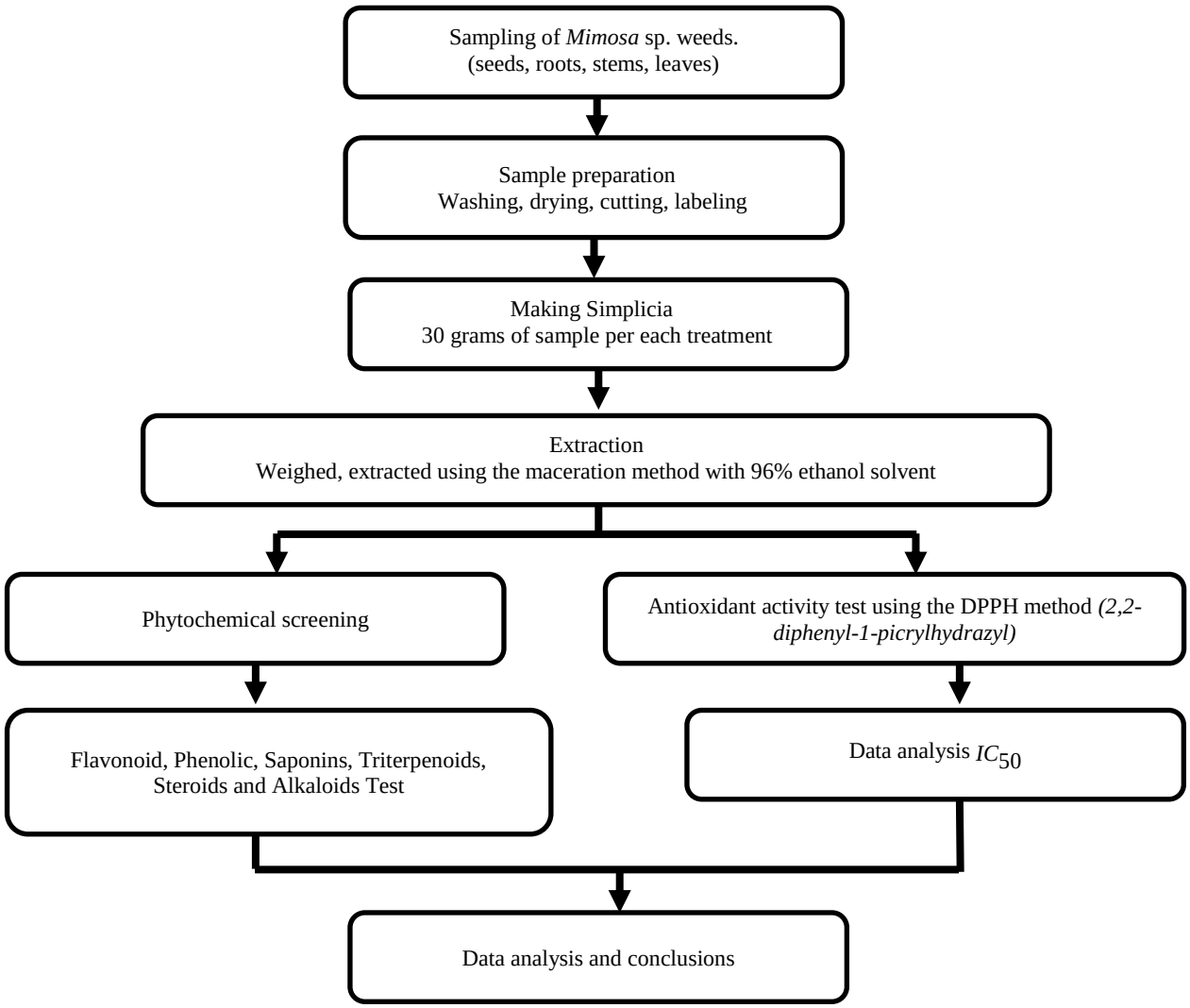

Figure 1. Research flow diagram

The mimosa weed that has been obtained is continued with the process drying, namely by drying at room temperature for seven days day and not exposed to sunlight. Then cut into small pieces according to each type. Each and every part of the weed that has been determined is then ground with Blend until no rough parts are visible and then

put it in the blender. plastic bags as much as 30 grams for each treatment and then stored in room temperature and label according to research treatment.

The sample is extracted by maceration (extraction method), 30 grams then put into a reagent bottle, then ethanol solvent is added 96% as much as 300 mL, then stirred with a stirring rod and covered tightly the whole thing with aluminum foil. Maceration is done for 3 days and stirred every 1 x 24 hours. The sample is stored in a cool place and low light. Then carry out the extraction process with a rotary evaporator buchi at a temperature of ± 50°C with a rotation speed of 60-90 rpm until concentrated macerate. Then transfer it into a reagent bottle. Then because the sample is not too thick and is continued with the oven process for 2 days. at a temperature of 40 °C until a really thick extract is obtained (Department of health, 1979). The extraction result is a concentrate obtained by extracting active substances from simple drugs using ethanol solvent.

The antioxidant activity test method used in this study was with the DPPH method. The principle of the DPPH method in capturing compounds free radicals is by measuring the capture of synthetic free radicals in organic solvents such as methanol at room temperature by a compound that has antioxidant activity. The advantages of the DPPH method are that it is easy, fast and sensitive (Mosquera et al., 2009). Observations made included IC50 data analysis and phytochemical test of *Mimosa sp*. Weeds. The research data were analyzed statistically with the F test at the 5% level and if F count > F table at 5%, then it continued with Duncan's New Multiple Range Test (DNMRT) at the 5% level. Correlations between variables were analyzed using correlation analysis with the Statistical Tool for Agricultural Research (STAR) application. The implementation of the research is presented in Figure 1.

3. Results and Discussion

3.1. Antioxidant Activity Test

The results of the analysis of antioxidant activity tests on *Mimosa sp*. weeds from various plant parts can be measured using UV-Vis spectrophotometry. Antioxidant content is expressed by the IC50 (Inhibitory concentration) value. 50%) or in other words the inhibitory concentration by capturing radicals free by 50%. To evaluate the suitability of selected weeds for antioxidant activity testing, sample of seed, roots, stems and leaves from 3 types of mimosa weeds were tested and their simplicial were well prepared. The result of the antioxidant content from various plant parts can be seen in Table 1, and the test samples along with the prepared simplicia are shown in Figure 2.

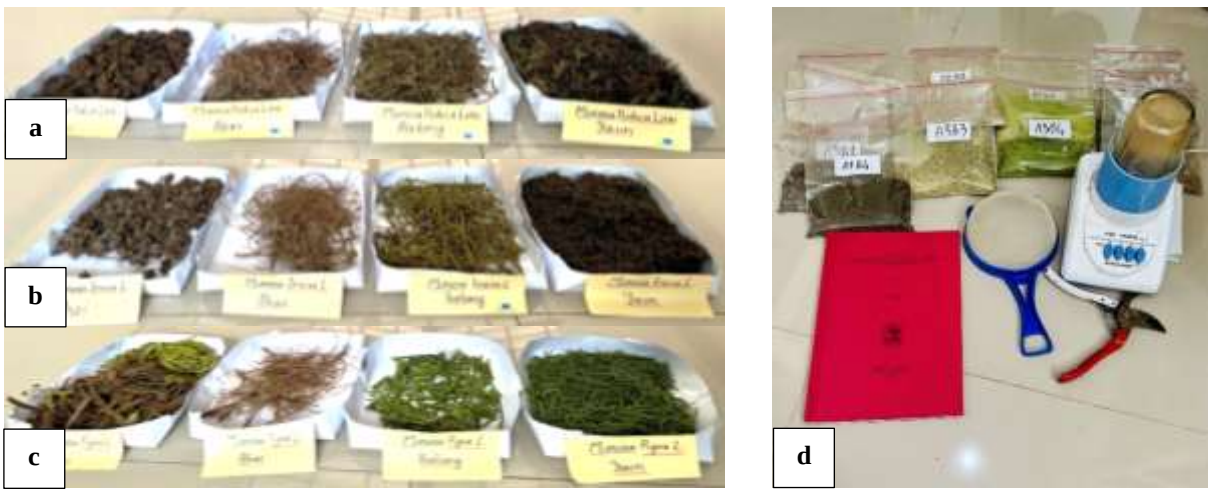

Figure 2. Test samples, a) *Mimosa pudica* L., b) *Mimosa invisa* L., c) *Mimosa pigra* L., d) Grinding of all samples before the extraction.

Table 1. Antioxidant activity of *Mimosa sp*. weeds from various plant parts with DPPH method

Test Weed	Plant Parts			
	Seed	Root	Stem	Leaf
	…….mg/L…….			
Mimosa pudica L.	2220,53±12.06 ^{bB}	5359,82±21.06 ^{bA}	1995,20±6.89 ^{aC}	323,69±0.63 ^{bD}
Mimosa invisa L.	3676,73±16.47 ^{aC}	22278,86±92.43 ^{aA}	783,15±2.15 ^{bD}	8363,63±25.66 ^{aB}
Mimosa pgira L.	239,03±0.77 ^{cC}	480,06±1.77 ^{cB}	650,67±2.28 ^{cA}	41,89±0.19 ^{cD}
CV = 1.30%				

The numbers in the same column followed by the same lowercase letter and the numbers in the same row followed by the same uppercase letter indicate no significant effect on the DNMRT test at ÿ=5% level. Very strong antioxidants have an IC50 value of less than 50 ppm, strong antioxidants have an IC50 value of 50-100 ppm, moderate antioxidants have an IC50 value of 101-150 ppm and weak antioxidants have an IC50 value of more than 150 ppm (Nihlati, 2010).

Table 1 shows that the results of the analysis of antioxidant activity tests on seeds, roots and the stems of all test weeds showed very weak antioxidant values., where it can be seen that there is an interaction between the type of weed and the plant parts of the mimosa weed. sp. on the IC50 values (antioxidant activity indicators). The results of the IC50 value of Seeds, roots and stems of the weeds *Mimosa pudica* L., *Mimosa invisa* L., *Mimosa pigra* L. produce antioxidants above 150 mg/L. except for the antioxidant value of weeds *Mimosa pigra* L. In the leaf section that produces an IC50 value below 50 mg/L namely the antioxidant value produced was 41.89 mg/L. *Mimosa invisa* L. has a very low IC50 value in the root section of 22278.86 mg/L, compared to *Mimosa pudica* L. 5359.82 mg/L and *Mimosa pigra* L. 480.06 mg/L. This shows that the type of weed and the plant parts interact to produce different antioxidant activities. In addition, the *Mimosa pigra* L. leaf part also showed differences in antioxidant activity values. In the leaves *Mimosa pigra* L. has the highest antioxidant activity value, namely 41.89 mg/L compared to *Mimosa pudica* L. 323.69 mg/L and *Mimosa invisa* L. 8363.63 mg/L.. This indicates that the antioxidant response produced in *Mimosa sp*. weeds are not uniform in all plant parts. Differences in antioxidant activity from the plant parts can be seen that the roots of all types of test weeds tend to have values the lowest IC50 compared to other parts, which indicates antioxidant activity. the weakest. While the leaves showing the highest IC50 value are *Mimosa pigra* L. which indicates stronger antioxidant activity compared to other parts. According to Jannah et al., (2018) the differences in antioxidant activity in plants including the weed *Mimosa sp*., caused by several factors affect the distribution and concentration of bioactive compounds in each plant parts. Environmental exposure and oxidative stress on leaves that caused by ultraviolet rays can produce reactive oxygen species (ROS) which has the potential to damage cells, therefore, to protect itself, the leaves produce antioxidant compounds such as flavonoids and polyphenols which can neutralize ROS. While in the root part which is underground protected from direct exposure to ultraviolet rays and has a high oxygen content lower, the oxidative stress on the roots is lower, so the need for antioxidant compounds is also less and naturally the activity antioxidants in the roots will be lower compared to the plant parts others. Although some parts of all types of test weeds have value Very weak antioxidants can also produce high levels of antioxidants which differ based on the type of weed and the specific part of the plant. This research is in line with Silva et al., (2017) which shows the antioxidant content in the roots is also very low, namely 254 µg/mL. indicates the presence of weak antioxidant activity. The composition of chemical compounds extracted from a plant can be influenced by several factors, one of which is the extracted growing parts. The difference in the extracted plant parts will affect the biological activity that occurs, because every part of the plant has different compound content. Other research also shows that there are several factors that influence the height of antioxidant activity including properties that are easily damaged when exposed to oxygen, light, high temperature, and drying (Hidayati et al., 2017).

3.2. Phytochemical Test of *Mimosa sp*. Weeds

Phytochemical screening is one of the tests carried out to know the chemical compound components of *Mimosa sp*. weeds from various plant parts, namely seeds, roots, stems and leaves. The results of phytochemical test on *Mimosa sp*. weeds from various plant parts can be seen in Tabel 2.

Table 2. Results of phytochemical tests of *Mimosa sp*. weed extracts on various plant parts.

Test Weeds	Plant Parts	Compound					
		Flavonoid	Phenolic	Saponins	Triterpenoid	Steroid	Alkaloid
Mimosa pudica L.	Seed	+	+	+	+	+	+
	Root	+	+	+	+	-	+
	Stem	+	+	+	+	-	+
	Leaves	+	+	+	+	+	+
Mimosa invisa L.	Seed	+	+	-	+	+	+
	Root	+	+	-	+	-	+
	Stem	+	+	+	+	+	+
	Leaves	+	-	+	-	+	+
Mimosa pigra L.	Seed	+	+	+	+	-	+
	Root	+	+	+	+	-	+
	Stem	+	+	+	+	-	+
	Leaves	+	+	+	+	+	+

Description: (+) contains compounds (-) does not contain compounds.

Table 2 shows that the results of phytochemical screening of ethanol extracts of *Mimosa sp*. weeds from various plant parts show different secondary metabolite compound contents. Overall, the extract of *Mimosa sp*. weed from various plant parts contains secondary metabolite compounds, namely flavonoids, phenolics, saponins, triterpenoids, steroids and alkaloids. The content of these compounds can be identified by looking at the color changes in each extract after it is added various reagents according to the predetermined research design.

The results of the phytochemical test showed that in the weed *Mimosa pudica* L. There are secondary metabolites including flavonoids, phenolics, saponins, triterpenoids, steroids and alkaloids but there are parts of the roots and stems that cannot metabolize secondary to steroids. Phytochemical tests on the weed *Mimosa invisa* L. contained metaboilite secondary compounds include flavonoids, phenolics, saponins, triterpenoids, steroids and alkaloids. but phenolic compounds, triterpenoids cannot be found in the leaves, then in the stems Seeds and stems cannot contain saponin compounds. Likewise, steroids also cannot contain saponins. found in the roots. Then in the weed *Mimosa pigra* L. there is secondary metabolites including flavonoids, phenolics, saponins, triterpenoids, steroids, and alkaloids almost all parts except steroid compounds are not found in parts of the roots and stems of the weed *Mimosa pigra* L.. According to Katuuk, (2018) the availability of secondary metabolites in a plant is influenced by several factors. Factors both internally and externally. Internal factors such as genes and environmental factors external factors such as light, temperature, humidity, soil pH, and nutrient content Nutrients in the soil and altitude can also influence content and availability of secondary metabolites.

Phytochemicals are active chemical compounds produced by plants. Plants are a source of both primary and secondary metabolites. secondary metabolites. Secondary metabolite compounds are chemical compounds that generally have the ability of bioactivity and function to defend yourself from an unfavorable environment such as temperature, climate, or pest and disease disturbances (Agustina et al., 2016).

4. Conclusion

Based on the research that has been conducted, it can be concluded that the esults of antioxidant activity tests using the DPPH method on three types of weeds *Mimosa sp*. from various plant parts have antioxidant activity. The antioxidant content in *Mimosa sp*. weeds has antioxidant activity. which vary from different plant parts. The antioxidant activity that the strongest was obtained from the leaves of the weed *Mimosa pigra* L. which has antioxidant value 41.89 mg/L. The results of the research that has been obtained can become knowledge in terms of determine the type of *Mimosa sp*. weed and its plant parts to optimize the result is to obtain the highest level of antioxidant activity.

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