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Testing the Content of Secondary Metabolite Compounds from Bajakah (*Spatholobus littoralis* Hassk) to be Utilized as Traditional Medicine

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Abstract. Indonesia has abundant biodiversity and great potential to be utilized in the health sector. For a long time, plants in Indonesia have been used for traditional medicine. The use of natural remedies is believed to be safer compared to consuming synthetic drugs. Plants used for traditional medicine are types that contain secondary metabolite compounds. Secondary metabolite compounds are energy or food deposits in plants and can be used when needed. Secondary metabolite compounds can also act as anti-diabetic agents, one of which is alkaloids. Studies have shown that the compounds found in Bajakah *Spatholobus litoralis* Hassk include alkaloids, flavonoids, terpenoids, saponins, and phenolics. Although much initial exploration has been conducted on the phytochemical potential of Bajakah, more in-depth and systematic scientific studies are still needed, especially to identify, isolate, and test the biological activity of each of these compounds.

Keywords: Metabolite Compounds; *Spatholobus littoralis* Hassk; Phytochemistry

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INTRODUCTION

Indonesia has abundant biodiversity and great potential to be utilized in the health sector. For a long time, plants in Indonesia have been used for traditional medicine. The World Health Organization, or WHO, also recommends maintaining health and addressing diseases using traditional medicine. The use of natural remedies is considered safer compared to consuming synthetic drugs. Plants that are used for traditional medicine are types that contain secondary metabolite compounds. Secondary metabolite compounds are energy or food reserves in plants and can be used when needed (Kristanti *et al.,* 2008). Secondary metabolites have three biosynthetic pathways for their formation, namely the acetate pathway, the shikimate pathway, and the mevalonate pathway (Julianto *et al.,* 2019).

Some secondary metabolite compounds such as flavonoids, alkaloids, saponins, tannins, steroids, and terpenoids are currently widely used as antibacterials (Habibi *et al.,* 2024). Secondary metabolite compounds can also act as anti-diabetes agents, one of which is alkaloids (Arfan dan Habibi, 2024). Bajakah is a climbing plant commonly found in the tropical forests of Kalimantan. For generations, the Dayak people have used bajakah as an herbal medicine for various types of illnesses, including chronic diseases such as cancer and diabetes.

Bajakah *Spatholobus littoralis* Hassk is a plant from the Angiospermae group, which belongs to the Leguminosae family, and grows in Kalimantan (Habibi *et al.*, 2024). Research conducted by (Habibi and Johannes, 2022) using bajakah spatholobus littoralis hassk as an antibacterial against S. aureus and *E. coli* showed that the study results indicated the ability to inhibit the growth of both bacteria.Mochtar et al., (2022) stated that bajakah bark extract can act as an antibacterial against *S. aureus* and can also act as an antifungal against *C. albicans***.** Some studies conducted (Habibi *et al*., 2024) indicate that secondary metabolite compounds produced by plants can act as antibacterial agents.

Hutasoit (2020) stated that one of the risk factors for diarrhea is poor food sanitation and contamination by the microorganism *Escherichia coli*. Rahman and Sumijan (2021) stated that the bacteria *S. aureus* in humans has varying levels of severity, ranging from minor skin infections such as furunculosis, impetigo, urinary tract infections, respiratory tract infections, to eye infections. According to Makhfirah et al. (2020), *Candida albicans* is one of the normal flora most commonly found in the oral cavity, skin, mucous membranes, digestive tract, respiratory tract, and vagina. Diseases caused by *Candida albicans* include oral candidiasis (moniliasis). Therefore, the bajakah plant can be used as a traditional medicine or first aid for several diseases caused by those bacteria and fungi.

Although there has been considerable preliminary exploration of the phytochemical potential of bajakah, more in-depth and systematic scientific studies are still needed, particularly to identify, isolate, and test the biological activities of each compound. Thus, research on the phytochemical compounds of bajakah not only contributes to the development of knowledge and technology in the pharmaceutical and biomedical fields but also supports the preservation of local knowledge and Indonesia's biological natural resources.

MATERIALS AND METHODS

The location of Bajakah plant sampling on Kalimantan Island for metabolite compound analysis testing can be seen in Figure 1.

Figure 1. Bajakah Plant Sampling Locations on Kalimantan Island for Metabolite Compound Testing

Bajakah is a traditional medicinal plant originating from the tropical forests of Kalimantan and is widely known by the Dayak people as a plant beneficial for medicinal purposes. Bajakah is generally a climbing plant with roots or stems that are used as herbal ingredients because they contain various secondary metabolites. On the island of Kalimantan, bajakah is found in several regions, one of which is South Kalimantan Province, which has a tropical rainforest ecosystem with high biodiversity. The humid environment, fertile soil, and relatively natural forest cover make South Kalimantan a suitable habitat that supports the growth of bajakah plants. The potential of bajakah as a medicinal plant has encouraged various scientific studies to examine its active compounds and pharmacological benefits.

The bajakah stems are washed with running water until clean, then finely chopped. Next, they are stored in an incubator at a temperature of 40°C and left for several days. After drying, they are ground into simplicia and soaked using 96% alcohol as a solvent. Soaking in alcohol is commonly referred to as extraction, which is the process of separating compounds based on their solubility (Badriyah., 2022).

The alkaloid test is carried out to determine the presence of alkaloid compounds in plant extracts. The procedure begins by taking about 2 to 3 mL of the plant extract, then adding 2 mL of 2N hydrochloric acid (HCl) solution. This mixture is heated for approximately 5 minutes to help dissolve the basic alkaloids. After cooling, the solution is filtered to obtain a clear filtrate. This filtrate is then divided into three separate test tubes, each of which will be tested with specific alkaloid reagents, namely Dragendorff, Mayer, and Wagner reagents. A few drops of reagent were added to each tube, and then the changes that occurred were observed. The formation of a precipitate indicates a positive result for the presence of alkaloids. An orange or brown precipitate indicates a positive reaction with Dragendorff's reagent, a creamy white precipitate indicates a positive reaction with Mayer's reagent, and a reddish-brown or red precipitate indicates a positive reaction with Wagner's reagent. This test is qualitative and is used as an initial identification of alkaloid content in plant materials (Sangi, 2008).

The flavonoid test aims to determine the presence of flavonoid compounds in plant extracts. The first step is to take about 2 mL of the plant extract into a test tube. Then, a small amount of magnesium (Mg) powder is added to the solution, followed by the addition of 1 to 2 drops of concentrated hydrochloric acid (HCl) solution. After adding the reagents, the mixture is left to react for a few minutes. A positive reaction is indicated by a color change in the solution, such as pink, red, purple, or orange. This color change results from the reduction of the carbonyl group in the flavonoid structure by magnesium, which then forms a colored complex compound with HCl. This test is known as the Shinoda reaction and is qualitative in nature, used as an initial indication of the presence of flavonoid compounds in plant samples (Whika 2017).

The terpenoid test, commonly known as the Liebermann-Burchard test, is carried out to detect the presence of terpenoid or steroid compounds in plant extracts. The procedure begins by placing about 2 mL of the plant extract into a test tube, then adding 2 mL of chloroform solvent. After being mixed thoroughly, 2 mL of concentrated sulfuric acid (H_2SO_4) is added slowly along the wall of the test tube to form two separate layers of liquid. The tube is then observed without shaking, as the reaction will occur between the extract layer and the sulfuric acid. If the extract contains terpenoid compounds, a color change will appear at the interface of the two layers, usually red, purple, blue, or green. This color change indicates a positive reaction for terpenoid or steroid compounds. This test is qualitative and is used as an initial method for identifying these compound groups in natural materials (Sulistyarini, 2020).

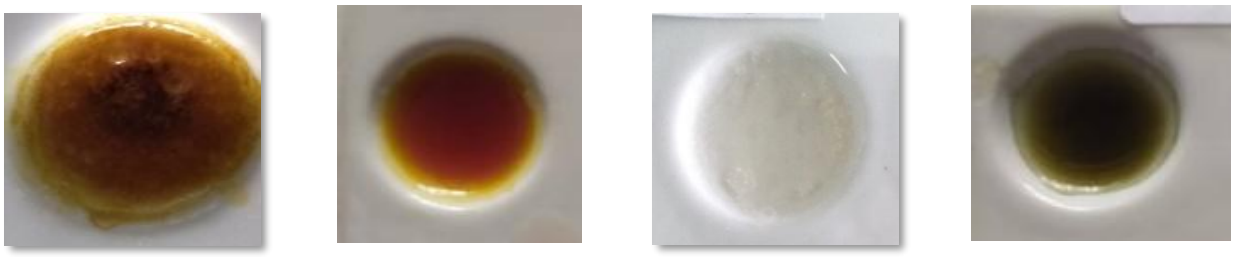
The saponin test is carried out to detect the presence of saponin compounds in plant extracts based on their ability to form stable foam. The first step is to put about 2 mL of the plant extract into a test tube, then add about 10 mL of hot water. The mixture is then shaken vigorously by hand for about 30 seconds to 1 minute. After that, the solution is left in an upright position for about 10 minutes. If a stable foam forms with a height of 1 cm or more that does not disappear during that time, the test result is declared positive for containing saponins. This stable foam is caused by the natural surfactant properties of saponins, which can reduce the surface tension of water and form long-lasting air bubbles. This test is qualitative and serves as an initial step to confirm the presence of saponins in plant samples (Kumalasari, 2020).

Phenolic testing was carried out to determine the presence of phenolic compounds, including tannins, in the plant extract. The procedure began by taking about 2 mL of the plant extract into a test tube, then adding 1 to 2 drops of 1% ferric chloride ($FeCl_3$) solution. After adding the reagent, the solution was observed for any color change. A positive result is indicated by the appearance of dark blue, dark green, purple, or black colors, depending on the type of phenolic compounds present in the extract. These colors appear due to the formation of a complex between Fe^{3+} ions and the aromatic hydroxyl groups in the phenolic compounds. This test is qualitative and is often used as an initial method in identifying phenolic compounds in natural materials or herbal products (Rukmini, 2019).

This study is a laboratory experimental research with an exploratory descriptive approach aimed at identifying the groups of secondary metabolite compounds in bajakah root extracts qualitatively by observing color changes in the extract after the addition of reagents. All testing was conducted in vitro in the laboratory.

RESULTS AND DISCUSSION

Phytochemical screening analysis is an important preliminary method for identifying the presence of bioactive secondary metabolites in medicinal plants. In this study, qualitative tests were conducted to detect alkaloids, flavonoids, terpenoids, saponins, and phenolic compounds in the ethanol extract of the bajakah plant samples *Spatholobus litoralis* Hassk. The research data results of *Spatholobus litoralis* Hassk can be seen in the Figure 2.



Alkaloid Falvonoid Saponin Fenolik

Figure 2. Phytochemical test results of Bajakah plants (*Spatholobus littoralis* Hassk)

In the research above, alkaloids are indicated by the formation of a brown-orange precipitate with Dragendorff's reagent. Alkaloids are nitrogen-containing compounds known to have various pharmacological effects, including analgesic, antimalarial, and antimicrobial activities. The detection of alkaloids in the extract indicates that the plant may have potential therapeutic properties (Habibi *et al*., 2024). The alkaloid content in bajak ah Spatholobus littoralis Hassk can be used for first aid as a traditional medicinal ingredient.

In the flavonoid test, a positive result was shown; a yellow precipitate indicates that the sample positively contains flavonoids. Flavonoids are known for their antioxidant, anti-inflammatory, and anticancer properties. Their presence in the extract can contribute to the plant's potential as a source of natural antioxidants and its ability to neutralize free radicals.

The saponin test conducted in this study showed the formation of foam/froth. Saponins are glycosides with soap-like properties, known for their expectorant, immunostimulant, and cholesterol-lowering effects. Their presence indicates potential health benefits, particularly in supporting the cardiovascular system and the immune system.

In this study, a greenish-black color was produced with the addition of ferric chloride, indicating the presence of phenolic compounds. Phenolic compounds are well known for their antioxidant activity, and they play a role in the prevention of diseases related to oxidative stress. The presence of phenolic compounds further supports the therapeutic potential of the plant extract. The research data results of *Spatholobus litoralis* Hassk can be seen in the Table 1.

Table 1. Secondary metabolite compound content of Bajakah (*Spatholobus litoralis* Hassk)

Number	Phytochemical Test	Test Results
	Alkaloid	+
1	a. Dragendorff	+
	b. Mayer	-
	Flavonoid	+
2	a. Lead acetate	+
	b. Powder Mg	-
3	Terpenoid	-
4	Saponin	+
5	Fenolik	+

The detection of various bioactive compounds in plant extracts indicates that these plants are a potential source of natural therapeutic agents. The presence of alkaloids, flavonoids, saponins, and phenolic compounds suggests a broad spectrum of pharmacological properties that can be explored in future research, including antimicrobial, antioxidant, and anti-inflammatory activities. Further quantitative research guided by bioactivity is recommended to isolate and characterize these active compounds.

CONCLUSION

Although initial exploration of the phytochemical potential of *Spatholobus littoralis* Hassk has been conducted, more in-depth and systematic scientific studies are still greatly needed, especially to identify, isolate, and test the bioactivity of each compound. Research on the phytochemical content of bajakah Spatholobus littoralis Hassk has found that this plant contains secondary metabolite compounds such as alkaloids, flavonoids, terpenoids, saponins, and phenolics. Therefore, this study concludes that *Spatholobus littoralis* Hassk contains a high amount of secondary metabolite compounds, which allows it to be used as a traditional medicine.

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CONFLICT OF INTEREST

The author declares no conflict of interest and takes full responsibility for the content of this article.

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