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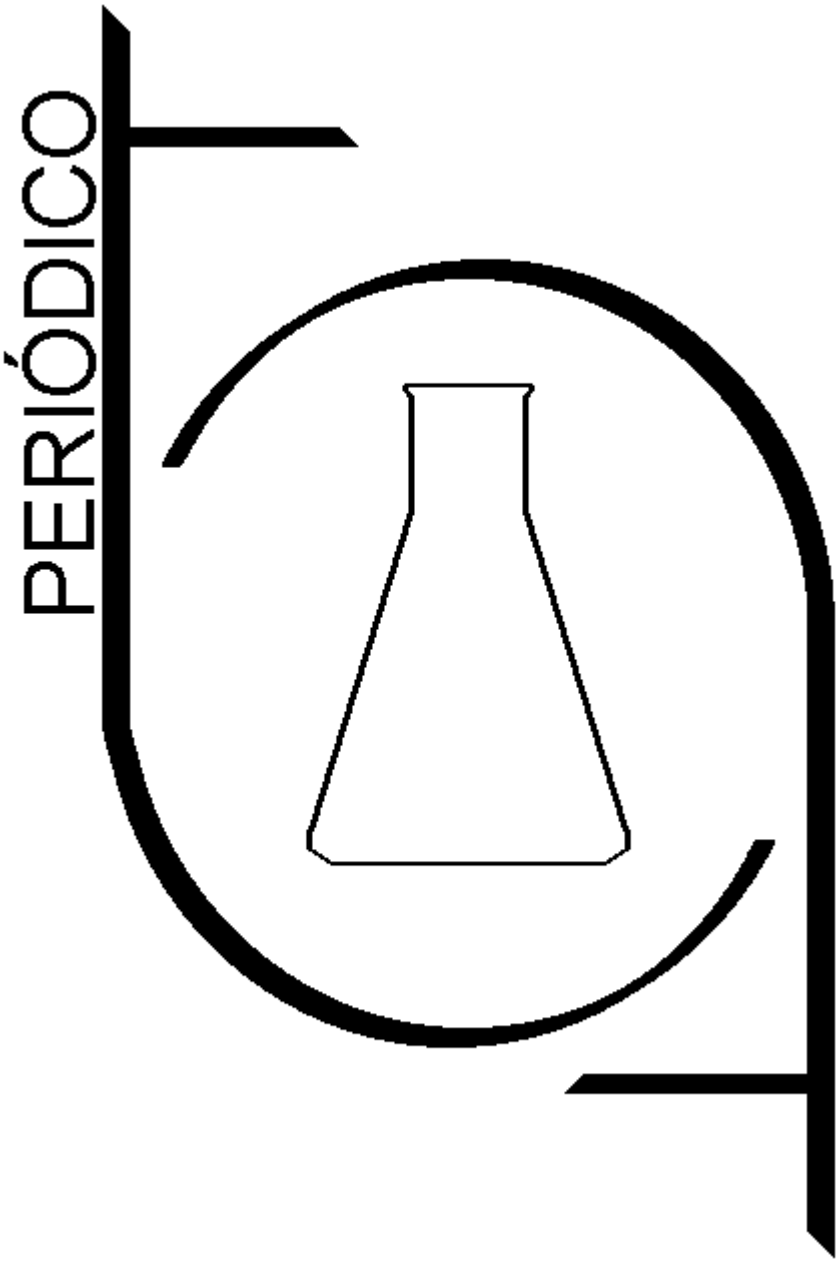

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PERIÓDICO TCHÊ QUÍMICA
ARTIGO ORIGINAL

A RECONSTRUÇÃO DO CONHECIMENTO CIENTÍFICO SOBRE A BIOATIVIDADE DE BAJAKAH KALALAWIT (*UNCARIA GAMBIR ROXB*) COMO ETNOMEDICINA

THE RECONSTRUCTION OF SCIENTIFIC KNOWLEDGE ABOUT BAJAKAH KALALAWIT (*UNCARIA GAMBIR ROXB)* BIOACTIVITY AS ETHNOMEDICINE

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RESUMO

A Indonésia tem mais de 25.000-30.000 espécies de plantas. A floresta tropical da Indonésia é uma fonte enorme de compostos metabólicos secundários benéficos para a saúde e a vida. Um dos tesouros é Bajakah Kalalawit (*Uncaria gambir roxb*), uma planta endêmica de Bornéu que se acredita hereditariamente curar tumores e cânceres. Esta pesquisa pertence a um estudo educacional que reconstruiu o conhecimento científico sobre as bioatividades de Bajakah por compostos de metabólitos secundários como etnomedicina e teve como objetivo restabelecer a pesquisa científica sobre bioatividades de Bajakah para medicamentos contra câncer e tumores. A madeira e a raiz de Bajakah Kalalawit da Floresta Nacional de Conservação, Samarinda, Indonésia, foram tomadas como amostra. O pó da raiz e da madeira foi isolado e extraído para seus compostos de metabólitos secundários usando água, etanol + água e etanol + hexano como solventes. Os isolados resultantes foram testados quanto à fitoquímica, estrutura e bioatividade em relação a *Bacillus subtilis* e *Escherichia coli (E.Colli)*. Os resultados foram apoiados por testes de estrutura com a espectroscopia FTIR que mostrou a aparência de captação de grupos funcionais para hidroxila, carbonila e aromática que correspondiam às moléculas secundárias de metabólitos. A análise dos dados obtidos concluiu que a raiz de Bajakah e o extrato de madeira contêm a atividade inibitória de células e tumores cancerígenos, pois contêm compostos de metabólitos secundários, incluindo terpenos, fenóis, alcalóides e flavonóides. Os compostos de metabólitos secundários dos isolados de Bajakah foram capazes de inibir a atividade de *Bacillus subtilis* e *Escherichia coli (E.Colli)*.

Palavras-chave: *Reconstrução, Bajakah (Uncaria Gambir Roxb), Planta Tropical, Conhecimento científico*

ABSTRACT

Indonesia has more than 25.000-30.000 plant species. The Indonesia tropical forest is a huge source for secondary metabolite compounds that are beneficial for health and life. One of the treasures is Bajakah (*Uncaria gambir roxb*), a plant endemic to Borneo that has been hereditarily believed to cure tumors and cancers. This research belongs to an educational study that reconstructed scientific knowledge about secondary metabolite compounds' bioactivities of Bajakah as ethnomedicine and aimed at reestablishing scientific research on bioactivities of Bajakah for cancer and tumor medication. The wood and root of Bajakah Kalalawit of the National Conservation Forest, Samarinda, Indonesia, were taken as the sample. The root and wood powder was isolated and extracted for their secondary metabolite compounds using water, ethanol + water, and ethanol + hexane as the solvents. The resulted isolates were tested for the phytochemical, structure, and bioactivity towards *Bacillus subtilis* and *Escherichia coli* (*E.Colli*). The results were supported by structure tests with FTIR spectroscopy, which showed the appearance of uptake of functional groups for hydroxyl, carbonyl, and aromatics that corresponded to secondary metabolite molecules. The analysis of the obtained data concluded that the Bajakah root and the wood extract contain the inhibitory activity of cancer cells and tumors because they contain compounds of secondary metabolites, including terpenes, phenols, alkaloids, and flavonoids. The secondary metabolite compounds from the Bajakah isolates were able to inhibit the activity of *Bacillus subtilis* and *Escherichia coli* (*E.Colli*).

Keywords: *Reconstruction, Bajakah (Uncaria Gambir Roxb), Tropical Plant, Scientific Knowledge.*

1. INTRODUCTION:

Indonesia has more than 25.000-30.000 plant species, 17.000 islands/isles, 50 types of ecosystem, and 300-700 ethnics (Kartawinata, 2010). The ethnic diversity of Indonesia has resulted in sundry cultures, traditions, and local wisdom. One of the local wisdom is the use of surrounding diversity as a medication of various diseases (Amir *et al*., 2017). Locals made use of local plants to maintain their health and are known as medicinal plants. The knowledge of medicinal plants is generally passed on orally so that knowledge is only limited to a group of people and is known as indigenous science (Kandowangko *et al.,* 2018; Aziz *et al*., 2018). This knowledge is vulnerable to degradation due to cultural acculturation and modernization (Mikako & Hirokazu, 2020). Thus, it needs to be conserved (Daval, 2009).

A study revealed that more than 80% of secondary metabolite compounds found in local plants are used as the first compound source to common medicines in the pharmaceutical industry (Fabricant & Farnsworth, 2001). Currently, research on local herbs as the traditional medication is a hot topic, particularly in ethnobotanical, ethnomedicine, and ethnopharmacology field (Kandowangko *et al*., 2018; Evrizal *et al*., 2013; Silalahi & Nisyawati, 2018; Lense, 2012).

Research about secondary metabolite compounds and their bioactivation to a particular disease is essential to carry out. Indonesia's tropical forest is a huge source for secondary metabolite compounds that are beneficial for health and life (Silalahi *et al*., 2015). One of the treasures is Bajakah (*Uncaria gambir roxb*), a plant endemic to Borneo that has been hereditarily believed to cure tumors, cancers; maintain stamina, and stop bleeding (Moris, 2020).

The utilization of Bajakah (*Uncaria gambir roxb*) by the Inland Dayak Tribe should be discussed in the context of ethnomedicine. Etymologically. The word 'ethnomedicine' means the connectivity of ethnicity and medicine as Local Knowledge. Scientifically, ethnomedicine is said to be a perception and conception of local people, and Local Knowledge in understanding health, or, research about the medical system of traditional ethnic (Bhasin, 2007). An ethnomedicine study is done to understand health from society's point of view to be reconstructed into scientific knowledge (Walujo, 2011; Walujo, Ethnopharmacology: Knowledge Saintification for the Development of the Drug and Pharmaceutical Chemical Industry in Indonesia, 2013).

Ethnomedicine, reviewed from the scientific field, is a part of anthropology that discusses medicinal plants, their ethnobotanics, and marketing (Lee *et al*., 2008). Moreover, it also talks about the bioactivities of the secondary metabolite compounds, morphological characters, and scientific explanations (Andrade-Cetto & Heinrich, 2011; Toksoy *et al*., 2010). Some medicines that derive from local knowledge include the quinine which is adapted from the knowledge of *Incas* who had long used *Chinchona* as a cure for malaria. There is also reserpine from *Rauwolfia serpentina* that has been utilized by the Indian community to reduce blood pressure. These medicines are some of the proofs of ethnomedicine development in recent years. Mostly, ethnomedicine focuses on finding new secondary metabolite compounds that are beneficial for modern medicine production to heal fatal diseases like tumors and cancers.

Public knowledge is correct at a certain level, but people should also be educated about a scientific explanation of a medicinal plant and how to protect the plant, which belongs to Indonesia's natural wealth (Hisa *et al*., 2018). The conservation knowledge of medicinal plants has been owned by the Marori tribe in Masur Merauke National Park and Karimunjawa society (Sudarmin *et al*., 2017; Supriyadi & Sudarmin, 2020). This research intends to follow the prior study, which provides explanations to the society about the medicinal plants. Frankly, this study is the development of the preceding research as it uses ethnoscience, ethnomedicine, and strengthened by laboratory-based scientific work in explaining people's indigenous science. Similar research was also done in Vietnam by (Hoang *et al.*, 2008), Turkey (Akbulut & Bayramoglu, 2013), Pakistan (Aziz *et al*., 2018), China (Lee *et al*., 2008), Cameroon (Mikako & Hirokazu, 2020), while here in Indonesia (Hisa *et al*., 2018; Hariyadi & Ticktin, 2010; Kandowangko *et al*., 2018; Lense, 2012; Silalahi, 2014; Silalahi *et al.,* 2015; Silalahi & Nisyawati, 2018; Supriyadi & Sudarmin, 2020; Septriyanto *et al.*, 2018) are researchers who are interested in benefitting local herbs as treatments.

Stood on the above description, inquiry-based findings related to the medicinal plant's advantage must be informed. The process of scientific explanation of public knowledge through scientific work-based inquiry in the laboratory is

known as the process of reconstructing scientific knowledge (Sudarmin *et al.*, 2019; Sumarni *et al*., 2016; Sumarni & Sudarmin, 2019). This research is important because public knowledge about traditional medicine and local knowledge has not been widely explained scientifically (Sumarni, 2019). Previously, students of a High School in Palangkaraya experimented on mice induced by tumor and cancer cell growth substances. They used Bajakah (*Uncaria gambir roxb*) extract as a medication for the mice and were succeeded in saving the mice's life. This result turns out to be the basis of this research in examining the ability of Bajakah (*Uncaria gambir roxb*) like cancer and tumor medication, and the secondary metabolite compounds contained in it.

This research belongs to an educational study that reconstructed scientific knowledge about secondary metabolite compounds' bioactivities of Bajakah as ethnomedicine and aimed at reconstructing scientific research on bioactivities of Bajakah for cancer and tumor medication.

2. MATERIALS AND METHODS:

2.1. Ethnomedicine Data Retrieval

The interviewee of this study was a 37 years-old native man who resides near the National Conservation Forest, Samarinda in which Bajakah comes from. He is also one of the many residents there who has used Bajakah to cure cancer and tumors for his relatives or neighbors. At present, he is cultivating and selling Bajakah wood and root to various regions through online sales. The research team obtained ethnomedical information about Bajakah and pictures from him.

This research belongs to an ethnomedicine study in which the data were gathered from a face to face interview (Akbulut & Bayramoglu, 2013). Referring to (Reyes-García *et al*., 2006) and Praptiwi's procedure (Praptiwi, 2004), the focus of this research include: (1) the local name of Bajakah (*Uncaria gambir roxb*); (2) characteristics of plants; (3) how plants are used as medicines; (4) ways to mix the fruit extract; (5) additive ingredients for the fruit extract; (6) its medical components; (7) ways of community conservation; and (8) seedling pattern. The data of organoleptic secondary metabolite test, phytochemical test, structure test, and antibacterial test were carried out a scientific inquiry at the Chemistry and Microbiology Laboratory at UNNES (Universitas Negeri Semarang). The inquiry activities included isolation and identification of phytochemicals and secondary metabolite structures of Bajakah (*Uncaria gambir roxb*) wood and root. The procedure of isolation and identification refers to the Organic Chemistry practicum manual prepared by UNNES Bioorganic Lecturer Team (Supartono *et al*., 2016), which is explained as follows.

2.2. The Isolation of Bajakah (*Uncaria gambir roxb*) Wood and Root from Borneo Island

The first step was the making of bajakah wood and root powder. The dried wood and root were cut into pieces and put in a blender at the UNNES Chemistry Laboratory to make a fine powder. The fine powder obtained was weighed (25 grams) then extracted by maceration procedure in an Erlenmeyer Glass (Merck brand) Volume 200 mL using 100 mL water solvent or 100 mL ethanol solvent. The solvent replacement was done every 24 hours and then filtered with filter paper. All macerates were collected and put into a rotary evaporator at 100^{o}C. Furthermore, the remaining filtrate was evaporated using a vaporizer cup in a water bath until a thick, stable isolate extract was obtained. As for other wood and root powder, the isolation

Other than the isolation and extraction, a Soxhletation process was performed to the powder sample using 50 mL of ethanol + 50 mL of n-hexane (pa) and 50 mL of ethanol + 50 mL of benzene (pa) for approximately 48 hours. At this point, the ethanol and benzene mixture solvent has isolated all secondary metabolite components of the powder. Then the solvent obtained from the Soxhletation process was filtered with filter paper. All the extractant was put into a rotary evaporator at 100^{o}C, and the obtained extractant as Bajakah (*Uncaria gambir roxb*) isolate was ready for Phytochemical testing, structure test with FTIR; and bioactivity testing of *Bacillus subtilis* and *Escherichia coli* bacteria.

In addition to the use of ethanol and benzene, a mixture of ethanol and hexane (pa) was also employed. The process of Soxhletation was the same for both samples from the root and wood powder, which was carried out, referring to Supartono *et al*. (2016).

2.3. Procedure for Phytochemical Test of the Secondary Metabolite Compounds

This step of the research was the phytochemical test and bioactivity test of Bajakah extract against *Bacillus subtilis* (positive gram bacteria) and *Escherichia coli* (negative gram bacteria). The research results were then

compared to prior studies and expert judgment about Bajakah (*Uncaria gambir roxb*), to produce an established reconstruction of scientific knowledge.

The procedure of the phytochemical test included several stages. Firstly, alkaloids identification using Mayer and Dragendorf reagents. The extract, as a result of isolation using methanol solvent, is shaken. If a deposition/white mist or an orange-red precipitate is formed after the Dragendoft reagent is added, it means that the Bajakah extract (*Uncaria gambir roxb*) contains Alkaloids. Secondly, steroids and terpenoids identification using Liberman Buchard. If a red or purplish-red mist is formed, then Bajakah isolate contains terpenoids, and if a green or bluish-green mist is formed, Bajakah isolate restrains steroids. Third, the flavonoids test by putting a few drops of Bajakah isolate water fraction into a test tube, then adding Mg metal powder and a few drops of concentrated HCl. If it turns into pink to red (except for isoflavones), then the isolate carries Flavonoids. Fourth, phenolics identification by adding several drops of water fraction of Bajakah isolate (*Uncaria gambir roxb*) into a test tube, then putting in some drops of $FeCl_3$. If it turns into blue or purplish-blue, the isolate is declared phenolics-positive. Last, saponin identification by putting 1 mL of Bajakah isolate water fraction into a test tube then shaken for 1-2 minutes. If temporal foam (which lasts for about 5 minutes) is built, then the isolate is saponin-positive.

2.4. Secondary Metabolite Structure Test with Elmer 100 FT-IR Perki Spectroscopy

In assisting the results of scientific knowledge reconstruction, a molecular structure test of Bajakah's secondary metabolite structures was carried out using the Perkin Elmer 100 FT-IR (Fourier Transform Infra-Red) spectroscopy. FT-IR is a tool employed to analyze chemical compounds. The infrared spectra of a compound can provide a picture and molecular structure of the compound. In this research, the test was carried out by following (Srinovaz, 2014) procedure.

In strengthening the findings of the phytochemical test and explaining scientifically about the secondary metabolites' type of functional group, the structural analysis of the functional group type was done using the Perkin Elmer Inc 10 FTIR spectroscopy (Figure 2a). A total of 1 mL of the sample (Figure 2b) of secondary metabolites as the result of Bajakah wood and root soxhletation with ethanol-hexane was prepared. Before analyzing the type of functional group, a temperature reconditioning and FTIR tool examination was carried out. Temperature recondition was done by pressing the power button and set to 25^{o}C. After the tool was set up, the next step is to examine the spectra data scan by clicking the background icon, filling in the sample name by writing 'Bajakah root sample-1', and set the wavenumber between 750-3700 cm^{-1}. A total of 1 µL of the root sample was injected into the holder sample; then, the scan icon was clicked. After about 8 minutes, a spectrum scan appeared.

The obtained data were then compared to those saved in the reference section by clicking 'setup' on the toolbar, chose 'compare references' → 'compare.' In a few minutes, the comparison spectra scan appeared. To sort the most similar references, the researchers clicked 'libraries' and 'search.' After a while, some references for the spectra scan popped out for the researcher to analyze carefully. Once the desired references have been found, then the researchers closed and saved them.

2.5. Antibacterial Bioactivity Test

The test procedure modified what has been done by (Septiani *et al*., 2017; Alen *et al*., 2009). The preparation stage included bacterial rejuvenation, bacterial suspension making, paper disc making (6 mm in diameter), preparation of negative and positive control, and concentration series making of 300, 400, and 500 mg/mL. The antibacterial activity test used was the Disc Diffusion method (Kirby-Bauer Test). The suspension of bacteria test, as much as 20 µL, was placed in the Petri then rubbed with sterile cotton on the test media (Gardjito *et al*., 2007). This procedure was repeated twice. The paper disc was placed above the media, which included 50 µg of Ciprofloxacin as the positive control, 20% of DMSO as the negative control, and 300, 400, and 500 mg/mL of ethanol extract from Bajakah (*Uncaria gambir roxb*) isolate. The media were then incubated at 37^{o}C for 24 hours, then the inhibition zone diameter was measured with a caliper expressed in millimeters.

2.6. Data Analysis

The research data obtained through interviews with a source person in the research site were analyzed. The questions raised to the interviewee were the local name, the characteristics of the plant, the benefits of the extract, and how to use it as cancer and tumor medication. the resource person, Moris (37 years

old) is a native of the community residing near the national tropical forest, Samarinda, Indonesia. The data taken from the interview were then reconstructed based on Hempel (2014). To strengthen the reconstruction, a series of experiments were conducted in the Chemistry Laboratory of Universitas Negeri Semarang (UNNES) for the isolation process, phytochemical tests, structure tests, and bioactivity tests of the extracts against *Bacillus subtilis* and *Escherichia coli*. The conclusion was drawn up based on the experiment results.

3. RESULTS AND DISCUSSION:

3.1. The Results of Scientific Knowledge Reconstruction

Figure 1 presents the pictures of Bajakah wood and Bajakah tea taken by Moris in the research location. Moreover, the data and information obtained from the interview are shown in Table 1. Departing from the interviewee's answers regarding the local name and characteristics, the researchers did a literature study to seek for the suitability of the data with the scientific records and found that the Bajakah mentioned by the interviewee belongs to Bajakah kalalawit (*Uncaria gambir roxb)*. Its leaves vary from yellow, brown, and white, while its small flower is purple, pink, and white.

The species contains phenol, antibacterial agent, and high catechins to prevent heart disease, obesity, and help the formation of collagen (Medical Team Universitas Lambung Mangkurat, 2017). The polyphenols are found in the leaves, yet the type and content are mainly affected by the leaf's age. Gardjito *et al*. (2007) revealed that Bajakah (*Uncaria gambir roxb*) leaves were found in compounds belonging to the phenolic group. The bioactivity of the compounds is presented in Table 2.

The results of interviews, as presented in Table 1, reveals that the community consumes Bajakah by brewing/boiling the dried leaves, bark, or root and drinks it as tea. This process, in the context of scientific knowledge, is called as the maceration process. The tea was observed to have reddish to yellow in color, which indicates the existence of secondary metabolite compounds. Moreover, in the context of scientific knowledge related to chemistry solution, the secondary metabolite compounds are solute while water is the solvent (Supartono *et al*., 2016). Another way to consume Bajakah is revealed by Uyung (2017) who found that there are two other species of Bajakah found in Borneo that are also believed to cure cancer, they are Bajakah Tampala (*Spatholobus Littoralis Hassk*) and Bajakah Lamei which grows in the tropical forest. Its stem stores much edible water and this water is commonly consumed as medication to cure various diseases.

The phytochemical test results of Bajakah (*Uncaria gambir roxb*) wood and root extract carried out in this research are presented in Table 3. Table 3 indicates that the secondary metabolite compounds found in this research are similar to those found in the prior study done in Universitas Lambung Mangkurat. These compounds result in bioactivity towards cancer and tumor cells that serve as an antibacterial agent and could stop bleeding. Nevertheless, the Ministry of Health of the Republic of Indonesia (2018) stated that Bajakah (*Uncaria gambir roxb*) as cancer, tumor, or other medication needs further research. On the other hand, Bajakah tea has empirically proven to hinder cancer cells by releasing hydroxyl compounds to bond the cancer cell so that the cell growth obstructs. For that reason, this study strengthens the phytochemical test for Bajakah isolates extracted using an organic solvent.

The results of the structure test with the FTIR Spectra Tool (Figure 3) showed the absorption of the main functional groups of secondary metabolite compounds contained in Bajakah wood and root extracts, namely hydrosol, carbonyl, aromatic, and methyl. The FT-IR spectra strengthen the presence of –OH (hydroxyl) and a carbonyl group. The presence of C-O bonds reinforces the -OH group, while the presence of methyl and methylene is shown by 100-1120 cm^{-1}. The results test indicated compatibility with the phytochemical test results of secondary metabolite compounds of bark and root extract (Medical Team of Universitas Lambung Mangkurat, 2017).

This research only shows the concordance of the research findings with the results by the medical team of Lambung Mangkurat University (2017) and has not shown the molecular structure of the secondary metabolite compounds. This follows the aim of the research, which is to explain why Bajakah extract is a potential cancer drug. This question has been answered by the finding of phenolics, terpenoids, and saponins. The analysis results showed that these metabolites can inhibit cancer cells since active groups such as hydroxyl groups (-OH) weaken cancer cells with different patterns of mechanisms (Panda, A, and Gunawan, YE, 2018, Maulidie, M *et al*, 2019). This is in line with Maulina *et al*. (2019), indicating that the phytochemical test for the rough extract of Bajakah

root dissolved in ethanol results in the same type of secondary metabolite compounds found in this research.

Furthermore, to determine the chemical structure and specific types for each secondary metabolite, it is necessary to purify and separate Bajakah extract isolates, followed by further structural analysis tests which include Ultra Violet Visible (UV-Vis) spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, and Carbon Core Magnetic Resonance Spectroscopy (13C-NMR). This research has not done these tests yet.

3.2 The Bioactivity of Secondary Metabolite Compounds with *Bacillus subtilis* and *Escherichia coli*

The antibacterial test toward Bajakah (*Uncaria gambir roxb*) isolates employed *Bacillus subtilis* (positive gram) and *Escherichia Coli* (negative gram). The test results are displayed in Figure 4 and Table 4. Based on this experiment, the inhibition test was performed, and the results are presented in Table 4. Table 4 informs that the bioactivity test results found that Bajakah (*Uncaria gambir roxb*) root isolate dissolved in water has a stronger inhibition zone than the isolate dissolved in ethanol or n-hexane, both for *Bacillus subtilis* and *Escherichia coli.* In other words, this study has granted a scientific explanation that Bajakah wood and root contain saponins as the antibacterial agent (Medical Team of Universitas Lambung Mangkurat, 2017). This is different from what was found by Gardjito *et al*. (2007) that the extract of polyphenols and catechins from *Uncaria gambir roxb* does not show as an antibacterial agent for *Escherichia coli*, but has antibacterial properties against *Staphylococcus aureus*.

4. CONCLUSIONS:

1. Bajakah root and wood extract contain the inhibitory activity of cancer cells and tumors as they contain secondary metabolite compounds including terpenes, phenols, alkaloids, and flavonoids;
2. The results were supported by structure tests with Perken Elmer Inc.10 FTIR spectroscopy, which showed the appearance of functional groups for hydroxyl (-OH), Carbonil (-C = O), which were bound to the structure of secondary metabolites. When cancer occurs, the oxidation process happens in Deoxyribonucleic acid (DNA), and the secondary metabolites found in Bajakah have the ability to act as antioxidants to protect DNA and inactivate the growth of cancer cells.
3. The secondary metabolite compounds from Bajakah isolates were able to inhibit the activity of *Bacillus subtilis* and *Escherichia coli* (*E.Colli*), yet the isolates embattle *E.Colli* stronger than *B. Subtili*.

This reconstruction is in line with what has been stated in the previous results about Bajakah's bioactivities. In other words, this research confirms prior research claims about the benefits of Bajakah (*Uncaria gambir roxb*) as ethnomedicine. It is expected that this study could be a reference for stakeholders to make use of Bajakah (*Uncaria gambir roxb*) as an alternative for cancer and tumor medication.

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Table 1. *The Interview Results*

No	Question	Answer
1.	What does Dayak Tribe call it?	Bajakah, it means roots in Dayak language. Literature results found that the Latin name for Bajakah is *Uncaria gambir roxb*.
2..	What are the characteristics of Bajakah?	Vines are growing from the trunk of the tree and twisting to other trees. The tree diameter can reach 10 cm. The color of the trunk is brown, the surface of the bark is rough and dry. It secretes clear water when cut. The surface of the leaves is delicate, and the branches grow parallel right and left.
3.	Before going viral, what are the advantages of the plant believed by the locals?	Bajakah has been used as a medicine for generations by the Dayak tribe since the nomadic life. Mostly, they consumed it to increase stamina when clearing forest land into fields.
4.	Which part of the tree is mostly utilized?	The main part is wood, but the leaves and roots are also used.
5.	What are the steps of extracting Bajakah traditionally?	Separate wood with its bark, wash and rinse with running water. Cut into small pieces having 4-5 cm in length and dry it under the sunlight. Then boiled the dried wood in 1 liter of water up to reaching the remaining half (0.5 liters). The water could be consumed 3 times a day. The wood could also be processed into powder by finely grounding the dried wood. The Bajakah powder can be consumed by brewing a teaspoon of powder with a glass of hot water.
6.	Do the locals conserve the plant?	They only take big Bajakah tree having > 4 cm in diameter.
7.	What do you know about Bajakah's chemical contents and their benefits?	I am aware of the research results done by scientists in Universitas Lambung Mangkurat that there are 40 substances advantageous for health, mainly for killing cancer/tumor cells.

Table 2*. The Bioactivity of Secondary Metabolite Compounds Found in Bajakah or Uncaria gambir roxb (The Medical School of Lambung Mangkurat, 2017)*

No	Secondary Metabolite Compound	Bioactivity and Benefit for Health
1.	Saponins	Antibacterial, lower cholesterol levels, fight cancer cells, prevent tumors, increase body immune
2.	Alkaloids	Relieve pain and stop bleeding
3.	Steroids	Accelerate wound healing, and maintain stamina
4.	Terpenoids	Antiseptic, anti-microbial, overcome the menstrual disorder, relieve inflammation, malaria and diabetes medication
5.	Flavonoids	Antioxidant, treat allergies, infections, and arthritis, restore damaged cells due to free-radical, maximalize the benefits of vitamin C
6.	Tanin	Antioxidant, diarrhea medication, the antibacterial, antidote
7.	Phenolics	Antioxidant, prevent heart disorders, prevent cancer cell growth, prevent diabetes

***Table 3**. The Phytochemical Test Results of Bajakah (Uncaria gambir roxb) Wood and Root Extract (Sudarmin et al., 2020)*

No.	Sample	Isolation and Extraction Process	Characteristics of Substances (Organoleptic)	Positive phytochemical and metabolite results
1.	Root	Soxhletation with an ethanol solvent	Yellowish orange liquid	Alkaloids, terpenoids, flavonoids,
		Soxhletation with ethanol and n-hexane solvent	Brownish orange liquid	Terpenoids
		Maceration with water solvent	Colorless liquid	Alkaloids, flavonoids, phenolics, and saponins
2	Wood	Soxhletation with an ethanol solvent	Yellow liquid	Terpenoids
		Soxhletation with ethanol and n-hexane solvent	Light brown or creme liquid	Unidentified
		Soxhletation with ethanol and benzene solvent	Light brown or creme liquid	Alkaloids, terpenoids, phenolics, and saponins

***Table 4.** Antibacterial Bioactivity Test Results of Bajakah (Uncaria gambir roxb) extract (Sudarmin et al, 2020)*

No	Sample	Solvent	Bacterial Inhibition
1.	Root	Water (Maceration)	The inhibition zone to *B. Subtili* is 12.25 mm and 61.25 mm to E. Coli
		Ethanol (Extraction)	The inhibition zone to B. Subtili is 0.00 mm and 55.00 mm to *E. Coli*
		Benzene (Extraction)	The inhibition zone to B. Subtili is 7.25 mm and 7.725 mm to *E. Coli*
2.	Wood	Water (Maceration)	The inhibition zone to B. Subtili is 70.50 mm and 10.25 mm to *E. Coli*
		Ethanol (Extraction)	The inhibition zone to B. Subtili is 66.00 mm and 8.25 mm to *E. Coli*
		Benzene (Extraction)	The inhibition zone to B. Subtili is 79.50 mm and 7.75 mm to *E. Coli*