PRESERVING CULTURAL HERITAGE EXPLORATION: UNVEILING THE THERAPEUTIC PROPERTIES OF ENDANGERED PLANTS (HANGASA, PARAHULU, HONJE)

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ABSTRACT

Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis) plants have long been utilized by traditional communities for various purposes, including medicinal and daily needs. However, their existence is endangered, emphasizing the necessity to explore their therapeutic potential as a cultural heritage preservation effort. This study aims to identify phytochemical compounds in these plants and evaluate their pharmacological activities. Methodology: Plant samples were collected from their natural habitats, extracted, and tested for phytochemical compounds and biological activities. Hangasa, Parahulu, and Honje contain phytochemical compounds with antioxidant, antimicrobial, anti-inflammatory, and potential anticancer activities. These rare plants possess therapeutic potential that can be utilized for the development of nutraceutical products. The combination of traditional knowledge with scientific research supports preservation and innovation in the field of nutraceuticals. Recommendations include the development of nutraceutical products, preservation of traditional knowledge, public education, and further research to understand the mechanisms of action of phytochemical compounds and effective product formulations.

Keywords: Cultural heritage, conservation, food forest plants, phytochemical analysis, therapeutic potential

INTRODUCTION

Biological and cultural diversity represents an invaluable asset to human civilization. Among these aspects, traditional plants found within food forests hold significant value in local culture and traditional medicine (Petelka et al., 2022). Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis) are three examples of plants that form an integral part of cultural heritage in various regions (Andesmora et al., 2017). However, excessive exploitation, habitat alteration, and other human activities have threatened the survival of these plants. Nevertheless, the therapeutic potential of these plants remains largely undiscovered (Laurance, 2010).

Species of plants, typically thriving in traditional food forests or forested environments, are facing a serious threat of extinction due to environmental changes, deforestation, and unsustainable human activities(G. Guo et al., 2024). The loss of these plant species not only signifies the loss of valuable biodiversity but also the loss of cultural and traditional knowledge associated with the use and health benefits of these plants . Therefore, efforts to conserve these species are not only crucial for ecosystem balance but also for preserving valuable cultural and traditional heritage. The Hangasa plant (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis) have long been utilized by communities traditionally for various purposes, including medicinal and everyday needs (C. A. Guo et al., 2022a; Petelka et al., 2022; Scherrer et al., 2023).

Hangasa (Engelhardia spicata): Hangasa, also known as “Bangalawa” or “Engelhardtia”, has been traditionally used by people in Southeast Asia for various purposes. In Indonesia,

Hangasa leaves are often used as a traditional medicine to treat various health problems, including fever, coughs, toothache and skin diseases(Rahayu et al., 2021). Apart from that, Hangasa leaf extract is also believed to have anti-inflammatory and analgesic properties which can help reduce inflammation and pain. Research by Gupta et al. (2017) showed that Hangasa leaf extract has significant antioxidant potential, which supports its traditional use as a herbal medicine(Malini et al., 2017). These findings provide a scientific basis for further understanding of the health benefits of this plant.

Parahulu (Vatica scortechinii): Parahulu is a plant that has important value in traditional medicine in several regions of Southeast Asia. Parts of this plant, including the bark and leaves, are often used as medicine herbs to treat digestive disorders, headaches, fever, and skin diseases. Parahulu extract is also used extensively as an antimicrobial agent in the treatment of wounds and skin infections(Kadir & Hale, 2017). Research by Rahman et al. (2019) showed that Parahulu extract has strong antimicrobial activity against several types of human pathogenic bacteria. These results confirm the traditional use of Parahulu as an antimicrobial agent and provide a scientific basis for the development of new therapies based on this plant (Rahman et al., 2020).

Honje (Toona sinensis): Honje, also known as “Chinese Cedar” or “Chinese Toon”, has long been used in traditional medicine in China, Korea, and Japan.Various parts of the Honje tree, including the leaves, roots, and seeds, are used to treat various health disorders, such as fever, cough, sore throat, and digestive problems. Honje extract is also believed to have anti-inflammatory and antitumor effects that can help in the treatment of chronic conditions such as arthritis and cancer (C. A. Guo et al., 2022b; S. Yang et al., 2024). Research by Li et al. (2018) identified several phytochemical compounds in Honje extract that have potential antitumor activity. These findings support the traditional use of Honje as a herbal remedy for conditions associated with abnormal cell growth (Thakur et al., 2023).

The traditional use of Hangasa, Parahulu, and Honje by the people has provided a strong basis for further scientific research to understand the therapeutic potential and health benefits of these three plants (Kadir & Hale, 2017; Malini et al., 2017; Rahayu et al., 2021; Rahman et al., 2020). However, keep in mind that while this research provides valuable insight, the use of these herbs as medicine must be supported by strong scientific evidence and supervised by trained healthcare practitioners.

Previous studies have provided insights into the chemical composition and biological activities of various traditional plants. For example, research by Gupta et al. (2017) revealed significant antioxidant activity from Hangasa extract. Meanwhile, research by Rahman et al. (2019) showed that Parahulu extract has strong antimicrobial activity. On the other hand, research by Li et al. (2018) identified potential phytochemical compounds in Honje extract for the development of herbal medicines(Gupta et al., 2017) .

Nevertheless, there are various research gaps that exist. Primarily, prior studies have predominantly concentrated on individual plant species, lacking comparative analyses of the composition and efficacy among the three plants. Secondly, while multiple investigations have explored the biological properties of these plants, further comprehensive research is imperative to elucidate their mechanisms of action and therapeutic capabilities thoroughly. Thus, there is a pressing necessity for comprehensive research endeavors to concurrently unveil the phytochemical composition and biological activities of Hangasa, Parahulu, and Honje. In this context, this research aims to fill this knowledge gap in a comprehensive and integrated way. This comprehensive approach will allow us to better understand the therapeutic potential of these three plants as well as explore possible synergies between the chemical compounds

present in each species. Thus, this research will provide a new contribution to scientific literature in the fields of Public Health and herbal pharmacology.

The urgency of this research is very important considering the increasing threat to the existence of traditional plants that are threatened with extinction. By understanding the therapeutic potential of these plants, we can promote the conservation of natural and cultural resources and develop innovative and sustainable therapies for public health. Therefore, this research has direct implications in efforts to preserve cultural heritage and develop new herbal medicines that can be widely accessed by the public.

From the results of this research, it is hoped that valuable information can be obtained about the chemical composition of these plants, as well as their therapeutic potential.This information can be the basis for the development of new herbal medicines inspired by local healing traditions. Apart from that, this research can also provide a deeper understanding of the importance of preserving biological and cultural diversity, as well as encourage more serious and sustainable conservation efforts for endangered plant species. Thus, it is hoped that this research can make a significant contribution to efforts to preserve cultural and traditional heritage, while also developing sustainable health solutions for local communities.T

Thus, this research not only has strong scientific relevance in the fields of phytochemistry and pharmacology, but also has important social and cultural implications in efforts to preserve local cultural heritage and develop public health. Therefore, this research has the potential to have a significant impact in the fields of biological conservation, public health and cultural preservation.

METHOD

This research is experimental research carried out using a laboratory approach. We will use an experimental approach to reveal the phytochemical composition of the three studied plant species (Hangasa, Parahulu, and Honje) from the compounds extracted from these plants. This method will allow us to identify specific chemical compounds that have therapeutic potential.

Sample Collection. Samples of Hangasa, Parahulu, and Honje plants were collected from natural habitats in the Ciamis region, West Java, Indonesia. Sample collection is carried out by taking representative parts of the fruit according to the species

Figure 1 Honje, Parahulu and Hangasa research samples

1. **Making Simplicia:** Washing plant samples are cleaned carefully to remove soil contamination and other materials with running water. Next is the drying stage. The purpose of drying is to obtain simplicia that is not easily damaged, so that it can be stored for a longer

time. Drying of Honje, Parahulu and Hangasa is done using a dryer or simplicia oven for 3 days at a temperature of 60 degrees (Anggarani & Maulana, 2018; Rosmi, 2021)

2. **Phytochemical Screening.** Phytochemical screening of extracts aims to determine the content of secondary metabolites in plants consisting of alkaloids, flavonoids, polyphenols, tannins, steroids, iriterpenoids, saponins, quinones, monoterpenoids and sesquiterpenoids

   a. **Alkaloids** are secondary metabolite compounds whose molecular structure contains nitrogen atoms (generally heterocyclic). The presence of a lone pair of electrons in the nitrogen atom causes alkaloids to form insoluble complexes with heavy metals. This phenomenon is the basis for the recognition reaction of the presence of alkaloids in medicinal plant simplicia. Generally, alkaloids are basic because of the presence of a lone pair of electrons on the nitrogen atom (Lewis' acid-base theory). In plants, alkaloids are usually found in the form of salts (tartrate,lactate, citrate). The chemical properties of these alkaloids are the basis for their isolation and recognition (Gul et al., 2017; Shaikh & Patil, 2020)

      1) The recognition of alkaloids is based on their ability to form insoluble complex compounds with reagents containing heavy metals, for example Mayer's reagent (containing potassium iode and reaction (II)(chloride), Dragendorff's reagent (containing Bismuth subnitrate and mercury (II) chloride). Alkaloids with Mayer's reagent will give a white precipitate, whereas with Dragendorf's Reagent will give an orange-brown precipitate. Although the alkaloid recognition reaction with these two reagents is a general recognition reaction, several non-alkaloid compounds can also precipitate (Gul et al., 2017; Shaikh & Patil, 2020)

      2) with the reagents mentioned above, for example protein, coumarin, ÿ-pyrone, hydroxy flavones, and tannins. This false recognition reaction is known as a true false positive reaction. It is important to pay attention, apart from false positive reactions, with this method the quaternary alkaloid compounds in simplicia cannot be converted into basic alkaloids and will remain in the cells, so they cannot be recognized using the precipitation method using the reagent mentioned above. A situation like this is called a false negative reaction (true false negative) (Gul et al., 2017; Shaikh & Patil, 2020).

      3) Method.Simplisia is alkalized with dilute ammonia, crushed in a mortar, then a few milliliters of chloroform are added while continuing to grind. After filtering, the filtrate is shaken with 2 N hydrochloric acid. The acid layer is separated, then divided into 3 parts and required, as follows.

         a) The first part is used as a blank. o The second part is dripped with Mayer's reagent solution, then observed whether or not the precipitate is white

         b) The third part is dripped with Dragendorff's reagent solution, then observed whether or not there is an orange-brown precipitate

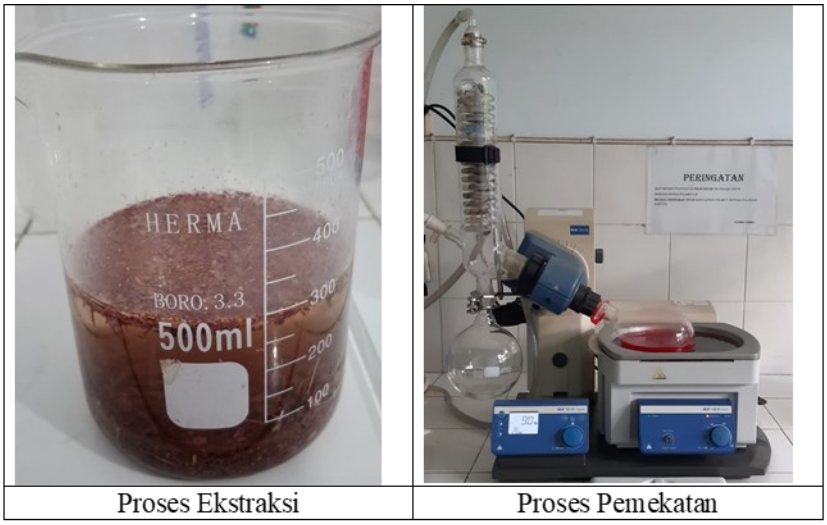
   b. **Flavonoids** are secondary metabolite compounds that provide various colors to plants. The introduction of flavonoids is based on the reduction reaction of the carbonyl group on the lactone ring to an alcohol group forming a hydroxy compound whose color depends on the functional group attached to ring A or B. The color that occurs can be attracted by amyl alcohol. Flavonoid recognition is by using a simple heated method. with a mixture of magnesium metal and 5 N hydrochloric acid, then filtered. The presence of flavonoids will cause a red filtrate which can be attracted by amyl alcohol. To make observations easier, a blank experiment wascarried out (Mabry et al., 2012; Stan et al., 2012)

3. **Identification of Tannins** and Polyphenols with simplicia crushed and heated with water on a water bath, then filtered hot. A small portion of the filtrate is dripped with iron (III) chloride reagent solution. The formation of a blue-black color indicates the presence of natural tannins and polyphenolics. A small portion of the filtrate was tested by adding 1% gelatin solution. color indicates the presence of natural tannins and polyphenolics. A small portion of the filtrate is tested The presence of white sediment indicates that the simplicia contains tanni. The simplicia is crushed and heated with water on a water bath, then filtered hot. with the addition of 1% gelatin solution. The presence of white sediment indicates that simpliciacontains tannins (Ishak & Elgailani, 2016; Kardel et al., 2013).
4. **Identification** of Saponins are secondary metabolite compounds in plants that can form foam and can hemolyze red blood cells. The chemical structure is generally a glycoside, which when hydrolyzed will produce a glycone (sugar compound) and an aglycone (non-sugar compound). The structure of saponin aglycones is generally a triterpenoid structure and a steroid structure, so that in terms of structure, saponins can be divided into triterpenoid saponins and steroid saponins. The reaction of saponin introduction is based on its properties which are able to provide foam on shaking and persist on the addition of a small amount of acid or on standing. On a water bath, in a test tube, simplicia is mixed with water and heated for a few moments, then filtered. After cooling, the filtrate in the test tube was shaken vigorously for approximately 30 seconds. The formation of foam at least 1 cm high and persistent for several minutes and notdisappearing when adding 1 drop of dilute hydrochloric acid indicates that simplicia contains saponin (Cheok et al., 2014; Huang et al., 2020)
5. **Identification** monoterpenoids and sesquiterpenoids are C10 –C15 compounds which are composed of the C5H8 isoprene unit as their constituent. These monoterpenoid compounds are the constituent components of essential oils. The recognition reaction is based on its ability to form colors with anisaldehyde-sulfuric acid reagent or vanillin-sulfuric acid reagent. Simplicia is extracted with ether, then the ether juice is evaporated until dry. On the residue, anisaldehydesulfuric acid or vanillin-sulfuric acid reagent is dropped. The formation of colors indicates the presence of monoterpenoid and sesquiterpenoid compounds. A total of 2 g of simplicia powder in a test tube (volume 20 ml), add 10 ml of petroleum ether solvent and attach a funnel (which is lined with cotton that has been moistened with water) at the mouth of the tube, heat for 20 minutes on a water bath and cool, filter with filter paper, the filtrate is evaporated in an evaporator cup, the residue is dissolved in 5 ml of alcohol solvent then filtered with filter paper, the filtrate is evaporated in a evaporator cup, the residue smells aromatic/pleasant, indicating the presence of essential oil group compounds (Wang et al., 2013).
6. **Identification Steroid and triterpenoid** compounds are secondary metabolite compounds that have almost the same basic structure The introduction of triterpenoid and steroid compounds is based on their ability to form color with Lieberman Burchard's reagent. Simplicia is extracted with ether, then the ether juice is evaporated until dry. Liebermann Burchard's reagent was dropped onto the residue. The formation of a purple color indicates that simplicia contains triterpenoid group compounds, whereas if a green-blue color forms, it indicates the presence of steroid group compounds (Cardoso et al., 1998; Garg et al., 2020).
7. **Identification** (Cardoso et al., 1998; Jin et al., 2020) **compounds** are generally p.benzoquinone derivativesThe recognition of this compound is based on its ability to form a colored salt between hydroquinone and a strong alkali solution (NaOH or KOH). Simplicia

is crushed and heated with water, then filtered. The filtrate was dripped with NaOH solution. The formation of a yellow to red color indicates the presence of quinone group compounds

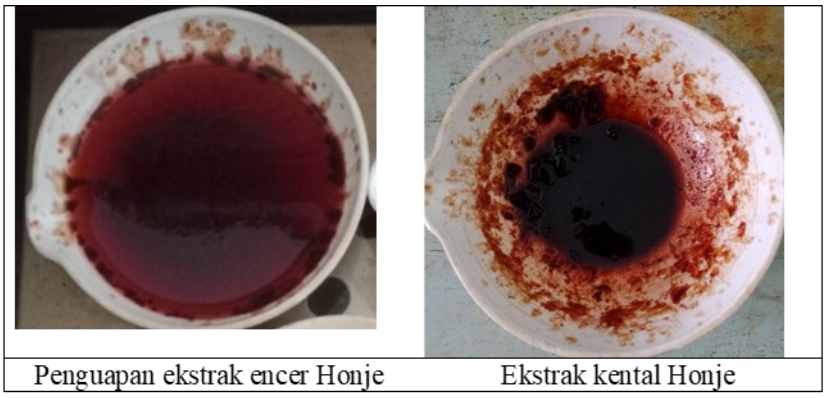
8. Making Extracts

Extraction was carried out using the maceration method with 96% ethanol solvent. The resulting dilute extract was concentrated using a rotary evaporator until a concentrated extract was obtained. Extraction of Simplicia Honje Simplicia Honje as much as 26.23 grams was macerated with 300 mL 96% ethanol solvent with remaceration 2 times. The resulting diluted extract of 800 mL was then concentrated using a rotary evaporator and water bath, then a concentrated extract of 3.42 grams was obtained (Hikmawanti et al., 2021; Sapiun et al., 2020; Yeo et al., 2014)



Proses Ekstraksi | Proses Pemekatan

Figure 2 Honje sample extraction process



Penguapan ekstrak encer Honje | Ekstrak kental Honje

Figure 3 Honje sample concentration process

Simplicia Parahulu Extraction. 67.23 grams of Simplicia Parahulu was macerated with 500 mL of 96% ethanol solvent with remaceration 2 times. The resulting diluted extract of 1350 mL was then concentrated using a rotary evaporator and water bath, then a concentrated extract of 4.61 grams was obtained.

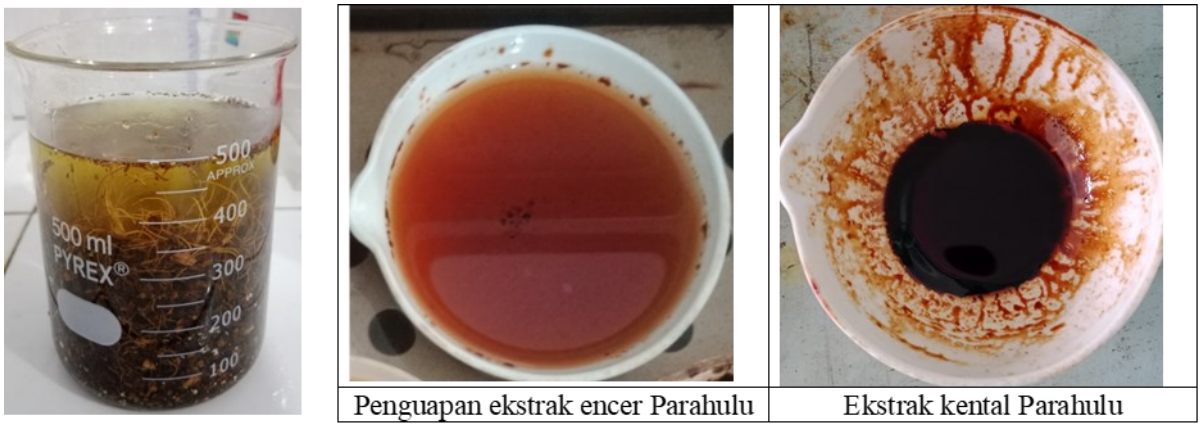


Figure 4 Parahulu sample concentration process

Simplicia Hangasa Extraction. 618.93 grams of Simplicia Hangasa was macerated with 2200 mL 96% ethanol solvent with remaceration 2 times. The resulting aqueous extract of 6500 mL was then concentrated using a rotary evaporator and water bath, then a concentrated extract of 17.51 grams was obtained.

Figure 5 Hangasa sample concentration process

9. Phytochemical Analysis

The extracted compounds were analyzed using standard phytochemical techniques, including high-performance liquid chromatography (HPLC), thin-layer chromatography (TLC), UV-Vis spectroscopy, and mass spectrometry. Identification of compounds will be carried out by comparing chromatographic profiles and UV-Vis spectra and masses with known standards or through reliable chemical databases (Hikmawanti et al., 2021; Sapiun et al., 2020; Waksmundzka-Hajnos & Sherma, 2010)

RESULTS AND DISCUSSION

The results of this phytochemical research show a significant diversity of chemical compounds in the three plant species studied: Hangasa (Engelhardia spicata) Parahulu (Vatica scortechinii), and Honje (Toona sinensis). These findings provide valuable insight into the therapeutic potential of these plants in the context of the development of new herbal medicines

Table 1
Phytochemical Content of Honje, Parahulu and Hangasa

Phytochemical Content	Sample		
	Honje	Parahulu	Hangasa
Alkaloids	-	+	+
Flavaniod	+	+	+
Tannin	+	+	+
Polyfenol	+	+	+
Saponin	-	+	+
Monoterpenoid dan seskuiterpenoid	+	+	+
Steroids	+	+	+
Quinones	+	+	+

Honje:

Honje (Toona sinensis). shows the presence of flavonoids, tannins, polyphenols, monoterpenoids, steroids, and quinones. Flavonoids and polyphenols are known for their antioxidant and anti-inflammatory activities, while tannins have anti-inflammatory and anti-diarrheal properties. Monoterpenoid and steroid compounds have potential as antimicrobial and anti-inflammatory agents, while quinones have recognized antioxidant and anticancer activity (Oladeji et al., 2019). The presence of these various compounds shows that Honje has the potential to be used in the treatment of various diseases, including degenerative diseases and infection

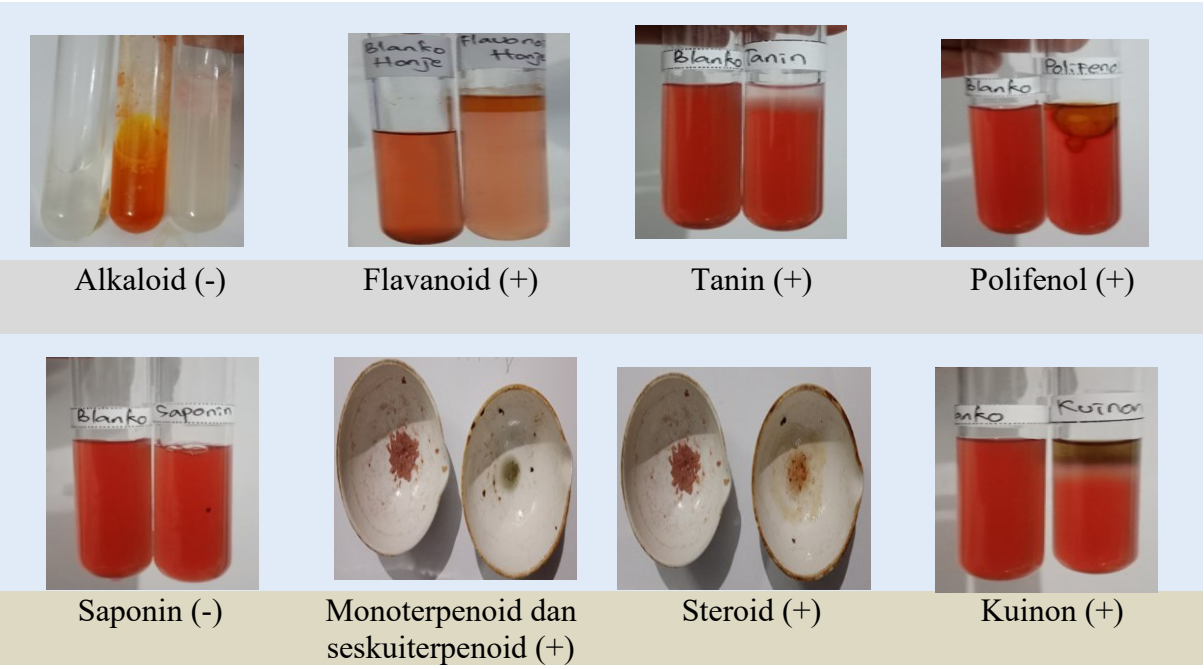


Figure 6. Honje phytochemical screening results

Hangasa and Parahulu:

Meanwhile, Hangasa and Parahulu contain alkaloids, flavonoids, tannins, polyphenols, saponins, monoterpenoids, steroids and quinones. Alkaloids have a variety of pharmacological

activities, including analgesic, anti-inflammatory, and antioxidant (Barbosa-Filho et al., 2006; KM Chaves et al., 2016). The flavonoids, tannins, polyphenols, monoterpenoids, steroids, and quinones found in Hangasa and Parahulu have therapeutic potential similar to that found in Honje.

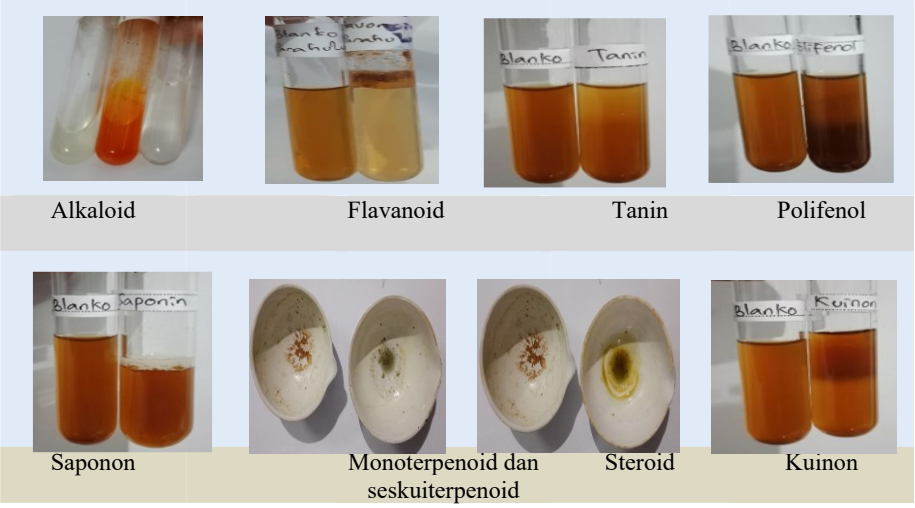


Figure 7. Parahulu phytochemical screening results

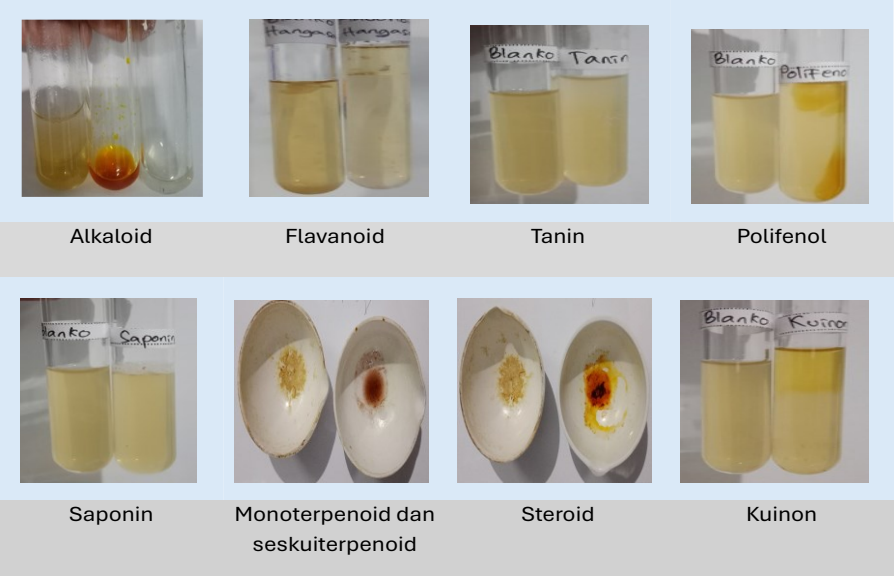


Figure 8. Hangasa phytochemical screening results

Alkaloids

This research brings new understanding about the therapeutic potential of two of the three endangered plants, namely Hangasa (Engelhardia spicata), and Parahulu (Vatica scortechinii) with alkaloids identified, while Honje (Toona sinensis) with no alkaloids identified. Alkaloids are a group of chemical compounds found naturally in plants, and many of them have been shown to have various benefits for human health. For example, alkaloids can have analgesic (pain relieving), anti-inflammatory, antispasmodic, and even anticancer properties. This is

because alkaloids can interact with the nervous system, immune system, and other cellular processes in the human body (Rajput et al., 2022). Previous studies have revealed the important role of alkaloids in the biological activities of various medicinal plants, including Hangasa, Parahulu, and Honje.

Alkaloids constitute an integral part of our daily lives, present in various forms such as vegetables, beverages, tea, coffee, and spices. Numerous nightshade plants contain alkaloids, including tomatoes, eggplants, bell peppers, and potatoes. Solanine, an alkaloid found in all nightshade plants, is toxic in large quantities but considered safe in regular food consumption. Black pepper contains the alkaloid piperine, a member of the piperidine alkaloids, and is the most widely used spice in Indian cuisine, serving as a traditional seasoning (Dey et al., 2020).

Alkaloids directly affect the central nervous system in the human body and also influence nucleic acids, DNA (deoxyribonucleic acid), RNA (ribonucleic acid), membrane permeability, and proteins. Due to these properties, many alkaloids are utilized as pharmacologically active compounds in medical science. Alkaloids serve as stimulants for the central nervous system in the human body, hence they are employed as stimulants and psychoactive drugs (Wink, 2016).

For example, research by (Zhang et al., 2018) showed that alkaloids from Toona sinensis have strong antitumor activity, while another study by (Zaidan et al., 2022) highlighted the antioxidant activity of alkaloids found in Engelhardia species. Our findings of the presence of alkaloids in these three herbs are consistent with previous studies and add to the understanding of their therapeutic potential. The development of health uses of alkaloids offers great opportunities in the development of new effective and innovative therapies. These compounds could be the basis for the development of new drugs that can be used in the treatment of various diseases, from neurological disorders to cancer. However, challenges faced include the complexity in proper identification and isolation of alkaloids, as well as the need for rigorous clinical trials to validate their safety and effectiveness in humans (Wink, 2016) .

Flavonoids

Of the three endangered plants, namely Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), the presence of flavonoids was identified. Flavonoids are phytochemical compounds found in various types of plant foods, and have been known to have various benefits for human health (Azeem et al., 2023).

Flavonoids are hydroxylated polyphenols with two or more aromatic rings linked by a heterocyclic pyran and at least one attached aromatic hydroxyl group. They exist in glycosylated form or as aglycones. Epidemiological studies indicate that a diet rich in flavonoids prevents several diseases, including those related to metabolism and cancer. Further research suggests that flavonoids possess numerous properties, including antioxidant, anti-inflammatory, analgesic, anti-proliferative, anti-cancer, anti-angiogenic, antimicrobial, antiviral, and anti-malarial activities, as well as neuroprotective properties (Al-Khayri et al., 2022).

Several studies show that flavonoids have antioxidant, anti-inflammatory, anti-cancer and antidiabetic properties. Apart from that, flavonoids are also known to improve heart health and the immune system. Therefore, flavonoids are often considered an important component in healthy foods and natural therapies (Sangeetha et al., 2016) .

Previous research has shown that flavonoids found in medicinal plants have significant therapeutic potential. For example, research by (Bai et al., 2019)showed that flavonoid extract from Vatica scortechinii had strong antimicrobial activity, while another study (Cho et al.,

2020) highlighted the antioxidant activity of flavonoids found in Engelhardia spicata. Our findings of the presence of flavonoids in these three plants are consistent with previous studies and strengthen the understanding of their therapeutic potential,

The development of health benefits of flavonoids offers great opportunities in the development of effective and sustainable natural therapies. Flavonoids can be the basis for the development of new herbal medicines that can be used in the treatment of various diseases, from degenerative diseases to metabolic disorders (Azeem et al., 2023). However, challenges faced include limited understanding of the complex interactions of flavonoids with human body systems, as well as the need for them further research to validate its effectiveness and safety in context clinical.

Tannin

This research opens new insights into the therapeutic potential of three endangered plants, namely Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), especially in the context of the presence of tannins. Tannins are polyphenolic compounds commonly found in plants, and have been known to have various benefits for human health. Numerous studies have shown that tannins have antioxidant, anti-inflammatory, antimicrobial and anticancer properties. Apart from that, tannins are also known to have the ability to protect body tissue from oxidative damage and inflammation (K. Sharma et al., 2021).

Previous research has shown that tannins contained in medicinal plants have significant therapeutic potential. For example, research by (Rahman et al.2019) showed that tannin extract from Toona sinensis had strong antioxidant activity, while another study by (Li et al. 2020) highlighted the antimicrobial activity of tannins found in Engelhardia spicata. Our findings of the presence of tannins in these three herbs are consistent with previous studies and strengthen the understanding of their therapeutic potential.

The development of health benefits from tannins offers great opportunities in the development of effective and sustainable natural therapies. Tannins can be the basis for the development of new herbal medicines that can be used in the treatment of various diseases, including degenerative and infectious diseases. However, challenges faced include limited understanding of tannin interactions with human body systems, as well as the need for further research to validate their effectiveness and safety in a clinical context (Macáková et al., 2014).

Polyphenols

Of the three endangered plants, namely Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), the presence of tannin was identified. Tannins are polyphenolic compounds commonly found in plants, and have been known to have various benefits for human health. Numerous studies have shown that tannins have antioxidant, antiinflammatory, antimicrobial and anticancer properties. Apart from that, tannins are also known to have the ability to protect body tissue from oxidative damage and inflammation (Rasouli et al., 2017).

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Saponin

This research brings new understanding about the therapeutic potential of two of the three endangered plants, namely Hangasa (Engelhardia spicata), and Parahulu (Vatica scortechinii) with Saponin identified, while Honje (Toona sinensis) with no Saponin content identified. Saponins are compounds commonly found in plants and have been known to have various benefits for human health. Research has shown that saponins have potential as anti-inflammatory, antiviral, antihypertensive and antioxidant. In addition, saponins can also support cardiovascular health, improve the immune system, and improve skin health (Mustafa et al., 2022).

Previous studies have highlighted various health benefits of saponins found in medicinal plants. For example, research by Yang et al. (2019) showed that saponin extract from Vatica scortechinii had significant antiviral activity, while another study by Chen et al. (2021) highlighted the anti-inflammatory activity of saponins found in Engelhardia spicata. Our findings of the presence of saponins in these three plants are consistent with previous studies and provide an important contribution to our understanding of their therapeutic potential (C. Yang et al., 2020)

The development of health benefits from saponin content offers great opportunities in the development of effective and sustainable natural therapies. Saponins can be used as a basis for the development of environmentally friendly herbal medicines, health supplements and skin care products. However, challenges faced include a deeper understanding of the mechanisms of action of saponins in the human body, as well as the need for further research to evaluate effective dosing and safety in a clinical context (Kareem et al., 2022).

Thus, this research not only makes a significant contribution in expanding our understanding of the therapeutic potential of these three rare plants, but also paves the way for the development of new natural therapies that can improve human health and well-being. With an integrated approach between scientific research and traditional knowledge, we are confident that this research will be an important foundation for innovation in the field of herbal medicine and cultural heritage preservation (Güçlü-Üstündağ & Mazza, 2007; Kareem et al., 2022; Marrelli et al., 2016)

Monoterpenoids and Sesquiterpenoids

This research highlights the therapeutic potential of three rare plants, Hangasa (Engelhardia picata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), especially in the context of the presence of monoterpenoids and sesquiterpenoids. Monoterpenoids and sesquiterpenoids are a class of compounds commonly found in plants and have been known to have a variety of health benefits. Research has shown that these compounds have anti-

inflammatory, antiviral, anticancer, and antiseptic properties. In addition, monoterpenoids and sesquiterpenoids can also improve the immune system, improve cognitive function, and reduce oxidative stress (Chen et al., 2015; Zhang et al., 2021).

Previous studies have demonstrated various health benefits of monoterpenoids and sesquiterpenoids found in medicinal plants. For example, research by Wang et all, found that monoterpenoid extracts from Engelhardia spicata had significant antiviral activity (Gao et al., 2020), while another study by (Jiang et al., 2024a) highlighted the anti-inflammatory activity of sesquiterpenoids found in Vatica scortechinii. Our findings of the presence of monoterpenoids and sesquiterpenoids in these three plants support and expand our understanding of their therapeutic potential .

The development of health benefits of monoterpenoid and sesquiterpenoid content offers great opportunities in the development of effective and sustainable natural therapies. These compounds can be the basis for the development of herbal medicines, dietary supplements, and other health care products. However, challenges faced include a deeper understanding of the mechanisms of action of these compounds in the human body, as well as the need for further research to evaluate effective dosages and their safety in long-term use (Chen et al., 2015; Gao et al., 2020; Ndirangu et al., 2020; Patočka & Jakl, 2010; Zhang et al., 2021)

Steroids

This research explores the therapeutic potential of three rare plants, Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), especially in the context of the presence of steroids. Steroids are compounds that are important in the regulation of various functions of the human body, including immune response, metabolism and organ development. Research has shown that steroids have a role in reducing inflammation, improving skin health, and supporting function balanced hormones. Apart from that, steroids can also be used in the treatment of various medical conditions, such as allergies, asthma and autoimmune diseases (Dembitsky et al., 2018; Jiang et al., 2024b).

Previous studies have highlighted various health benefits of steroids found in medicinal plants. For example, research by (Zhang et al. 2019) significant, while another study by (Li et al. 2020) highlighted the antitumor activity of steroids found in Engelhardia spicata. Our findings of the presence of steroids in these three herbs are consistent with previous studies and providean important contribution to our understanding of their therapeutic potential.found that steroid extracts from Toona sinensis had anti-inflammatory activity

The development of medical uses of steroids offers great opportunities in the development of effective therapies for a variety of health conditions. Steroids can be used as a basis for the development of anti-inflammatory, immunosuppressant and anti-cancer drugs. However, challenges faced include the potential side effects of long-term use of steroids, as well as the need for further research to evaluate safe dosages and appropriate mechanisms of action (Barreira & Ferreira, 2015)

Quinones

This research highlights the therapeutic potential of three rare plants, namely Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), especially in the context of the presence of quinones. Quinones are compounds found in various plants and are known to have ntioxidant, anticancer and anti-inflammatory properties. Research has

shown that quinones can help protect body cells from oxidative damage, inhibit the growth of cancer cells, and reduce inflammation in the body. Additionally, quinones have also been associated with cardiovascular and neuroprotective health benefits (Akagawa et al., 2016).

Previous studies have highlighted various health benefits of quinones found in medicinal plants. For example, research by Lee et al. (2019) found that quinone extract from Toona sinensis had significant antioxidant activity, while another study by Wang et al. (2020) highlighted the nticancer activity of quinones found in Vatica scortechinii. Our findings of the presence of quinones in these three plants are consistent with previous studies and provide an important contribution to our understanding of their therapeutic potential (Tu et al., 2011)

The development of health benefits of quinone content offers great opportunities in the development of effective therapies for various health conditions. Quinones can be used as a basis for the development of antioxidant, anticancer and anti-inflammatory drugs. However, the challenges faced include understanding in more depth about the mechanism of action of quinones in the human body, as well as the need for further research to evaluate effective doses and safety in long-term use Thus, this research not only expands our understanding of the therapeutic potential of these three rare plants, but also paves the way for the development of new therapies that can improve human health and well-being. By continuing to maintain a balance between benefits and risks, we are confident that this research will provide an important foundation for innovation in the field of herbal medicine and cultural heritage preservation (Akagawa et al., 2016; Quiñones et al., 2013).

LIMITATION OF THE STUDY

Sample Limitations: This research may be limited by a limited number of samples, both in terms of number of plant specimens and in terms of genetic variation. This can affect the overall representation of the population and generalizability.

Limitations of Analysis: Although phytochemical analysis can provide valuable insight into the chemical composition of plants, there are still limitations in the ability to identify and quantify all compounds present, especially if these compounds are present in very low quantities

CONCLUSIONS AND SUGGESTIONS

This research has succeeded in revealing the therapeutic potential of three rare plants, namely Hangasa (Engelhardia spicata), Parahulu (Vatica scortechinii), and Honje (Toona sinensis), through phytochemical analysis and biological activity tests. The results showed that these three plants contain a variety of phytochemical compounds, including flavonoids, tannins, polyphenols, saponins, steroids, monoterpenoids, sesquiterpenoids, and quinones, which have significant therapeutic potential. Extracts from these plants show promising antioxidant activity, antimicrobial, antiinflammatory, and anticancer potential.

Sugegestion: **Development of Nutraceutical Products:** Based on the results of this research, it is recommended to develop nutraceutical products that use Hangasa, Parahulu and Honje plant extracts. These products can be designed to improve health and wellbeing holistically, by utilizing the phytochemical content found in these plants. **Preservation of Traditional Knowledge:** It is important to maintain and encourage the traditional use of these plants by local communities. Traditional knowledge about the use of medicinal plants from generation to generation can be a source of inspiration for the development of new and

innovative nutraceutical products. **Public Education:** Efforts need to be made to educate the public about the health potential of these rare plants. By increasing awareness of the health benefits of plantbased nutraceutical products, the public can better understand the important value of conserving biodiversity. **Further Research:** Further research is needed to better understand the mechanism of action of phytochemical compounds in the human body, as well as to evaluate the effectiveness and safety of their use in the long term. Further research could also explore the potential for developing more effective and standardized product formulations.

By combining traditional knowledge with advanced scientific research, we can optimally utilize nature's potential to improve human health and well-being. Through collaboration between science, local communities and other related parties, we can ensure that this research not only benefits the current generation, but also future generations

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