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PHYTOCHEMICAL PROFILE AND ANTIOXIDANT POTENTIAL OF ETHANOL EXTRACT FROM GATAL LEAVES (*Laportea Decumana*) OF MALUKU

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Abstract

This study aimed to evaluate the phytochemical profile and antioxidant activity of ethanol extract from Gatal leaves (*Laportea decumana)* sourced from Maluku. Dried leaf powder was extracted with 96% ethanol over three cycles of 24 hours, followed by concentration using a rotary evaporator. Qualitative phytochemical screening confirmed the presence of phenols, flavonoids, alkaloids, tannins, and terpenoids, while saponins and steroids were not detected. Phenols and flavonoids were identified as the dominant bioactive compounds responsible for strong antioxidant properties. Antioxidant activity was assessed using the DPPH assay, yielding an IC_{50} value of 55.31 ppm slightly higher than the positive control, vitamin C (IC_{50} = 47.20 ppm) indicating potent free radical scavenging ability. These findings confirm that the ethanol extract of Gatal leaves is rich in bioactive phytochemicals, particularly antioxidants, and holds significant potential as a natural raw material for the development of herbal or nutraceutical products.

Keywords: *Gatal Leaves*, Phytochemical Profile, Antioxidant Activity, Ethanol Extract, Maluku

Abstrak

Penelitian ini bertujuan untuk mengevaluasi profil fitokimia dan aktivitas antioksidan ekstrak etanol daun Gatal (Laportea decumana) asal Maluku. Serbuk daun kering (50 g) diekstraksi dengan etanol 96 % (500 mL) selama tiga siklus 24 jam, dilanjutkan dengan pengekstrakan menggunakan rotary evaporator. Hasil uji fitokimia secara kualitatif menunjukkan keberadaan fenol, flavonoid, alkaloid, tanin, dan terpenoid, sementara saponin serta steroid tidak terdeteksi. Fenol dan flavonoid merupakan senyawa utama yang dominan dan berperan sebagai antioksidan kuat. Aktivitas antioksidan diuji dengan metode DPPH, menghasilkan nilai IC_{50} sebesar 55,31 ppm, yang hanya sedikit lebih tinggi dari standar vitamin C (IC_{50} = 47,20 ppm), menunjukkan kemampuan menetralkan radikal bebas yang sangat baik. Hasil ini mengonfirmasi bahwa ekstrak etanol daun Gatal kaya akan senyawa fitokimia bioaktif, terutama yang bermanfaat sebagai antioksidan, dan berpotensi besar sebagai bahan baku dalam pengembangan produk herbal atau nutraceutical alami.

Kata Kunci: Daun Gatal, Profil Fitokimia, Aktivitas Antioksidan, Ekstrak Etanol

1. Introduction

Indonesia is renowned as a country with exceptionally rich biodiversity, particularly in tropical regions such as Maluku. The floral diversity in Maluku encompasses a wide array of medicinal plants with significant potential for development as raw materials in pharmaceuticals and traditional medicines (Kurniawan, 2020). Favorable natural conditions—high temperatures, stable humidity, and fertile soils—foster the robust growth of herbal plants, making Maluku a crucial source for the exploration of bioactive compounds from medicinal plants.

Figure 1. Gatal leaves (*Laportea decumana*)

Laportea decumana, commonly known as Gatal leaf, is one such endemic plant found in this region. It is believed to contain phytochemicals with notable pharmacological potential, including antioxidant, antibacterial, and anti-inflammatory activities, which may serve as a foundation for developing alternative therapies (Hartono, 2019). However, studies on the specific chemical composition of *Laportea decumana* leaves remain limited; thus, in-depth analysis is necessary to map the phytochemical profile of this plant extract.

Natural antioxidants derived from plants—particularly phenolic compounds, flavonoids, and terpenoids—are capable of scavenging free radicals through redox mechanisms, thereby preventing cellular damage (Wijaya, 2022). Previous research has demonstrated that tropical medicinal plants, including those from Maluku, are rich in antioxidant phytochemicals, establishing them as valuable sources for plant-based prevention and therapeutic strategies. Consequently, identifying antioxidant compounds in *Laportea decumana* leaves is not only essential for understanding its role in traditional medicine but also for developing modern pharmaceutical formulations based on local biodiversity.

Phytochemical screening is a standard method used to detect bioactive compounds in plants and serves as a critical initial step in pharmaceutical research (Sari, 2018). Through this process, key compounds such as phenols, flavonoids, alkaloids, tannins, terpenoids, saponins, and steroids can be identified. Determining the chemical constituents of *Laportea decumana* leaves from Maluku will strengthen our understanding of their pharmacological properties and pave the way for more precise and targeted medical applications.

This study aims to conduct phytochemical screening and evaluate antioxidant activity of *Laportea decumana* leaf extract from Maluku to characterize the primary chemical components present. This knowledge is essential as a scientific foundation for developing raw materials from endemic plants for traditional medicine, while also providing a reference for future focused and applied pharmaceutical research (Lestari, 2021).

2. Methodology

2.1. Materials

Materials and Equipment
Equipment Used: A set of laboratory glassware, filter paper, analytical balance, magnetic stirrer, Buchi R-200 rotary evaporator (equipped with heating and vacuum cooling system), and Shimadzu UV-1800 UV-Vis spectrophotometer. Materials Used: 96% ethanol (Merck), hydrochloric acid (Sigma Aldrich, analytical grade), sodium chloride (powder) (Fisher Scientific), Wagner's reagent (Merck), concentrated sulfuric acid (H_2SO_4, reagent grade), magnesium powder (ACS grade), iron(III) chloride (Merck), DPPH (Sigma Aldrich, purity ≥ 98%), and distilled water.

2.2. Methods

Extraction of Gatal Leaves
Dried Gatal leaf powder (50 g) was macerated with 500 mL of 96 % ethanol in an Erlenmeyer flask sealed with aluminum foil. The maceration was performed three times (3 × 24 h) under protection from direct light. After maceration, the mixture was filtered through filter paper. The filtrate obtained was concentrated with a rotary evaporator until all solvent evaporated, yielding a viscous Gatal leaf extract.

Phytochemical Tests
Flow diagram of the phytochemical tests, presented in Figure 2.

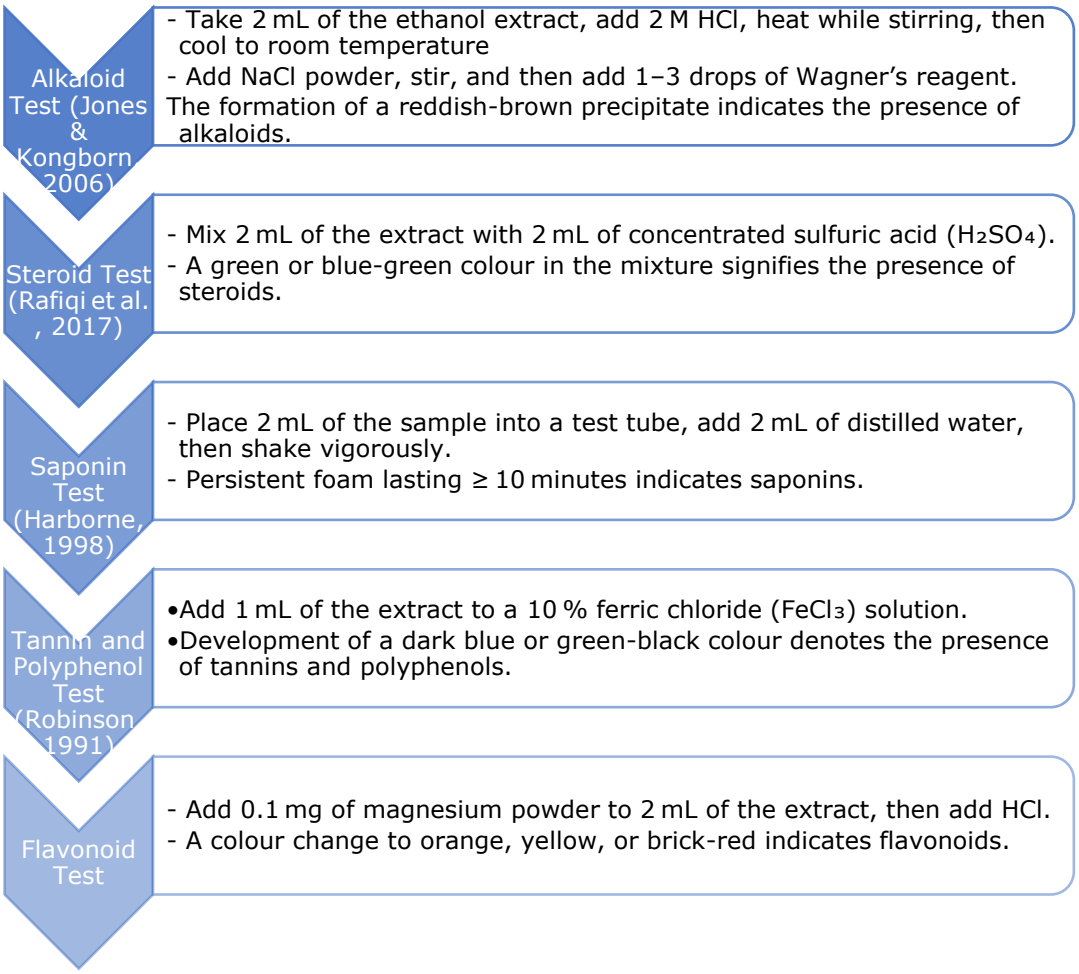

Figure 2. The flow diagram of phytochemical test

Antioxidant Activity Assay (Salampe et al., 2019)
Antioxidant activity of the Gatal leaf extract was determined using the DPPH method. One milliliter of the concentrated Gatal leaf extract at concentrations of 20, 40, 60, 80, and 100 ppm (µg/mL) was pipetted into test tubes. This extract solution was then mixed with 1 mL of 100 ppm DPPH in methanol and diluted to a total volume of 5 mL. The resulting solution was incubated in the dark at room temperature for 30 minutes. After incubation, absorbance was measured at 517 nm using a UV-Vis spectrophotometer.

Antioxidant activity was expressed as percentage inhibition, calculated using the following formula:

$$\% \text{ Inhibition} = \frac{Ao - Ai}{Ao} \times 100\%$$

% Inhibition = Percentage inhibition or scavenging capacity (%)
Ao = Absorbance of the blank (solvent + DPPH)
Ai = Absorbance of the sample (solvent + DPPH + extract)

The percentage inhibition data were used to determine the IC_{50} value, which represents the concentration of the extract required to reduce the free radical DPPH by 50%.

3. Result and Discussion

3.1 Phytochemical Screening

This study revealed that the ethanol extract of Gatal leaves from Maluku contains various important phytochemical compounds with potential pharmacological benefits. Through qualitative phytochemical tests, the presence of phenols, flavonoids, alkaloids, tannins, and terpenoids was

confirmed in the extract. All these compounds showed characteristic reactions with specific reagents, indicating their actual presence. Notably, saponins and steroids were not detected, which serves as a distinctive chemical fingerprint of this extract compared to other medicinal plants. The phytochemical activity results are presented in Table 1 and Figure 3 below.

Table 1: Results of Phytochemical Screening of Gatal Leaf Ethanol Extract

Phytochemical Test	Result
Alkaloid	Positive
Steroid	Negative
Saponin	Negative
Tannin	Positive
Phenol	Positive
Flavonoid	Positive
Terpenoid	Positive

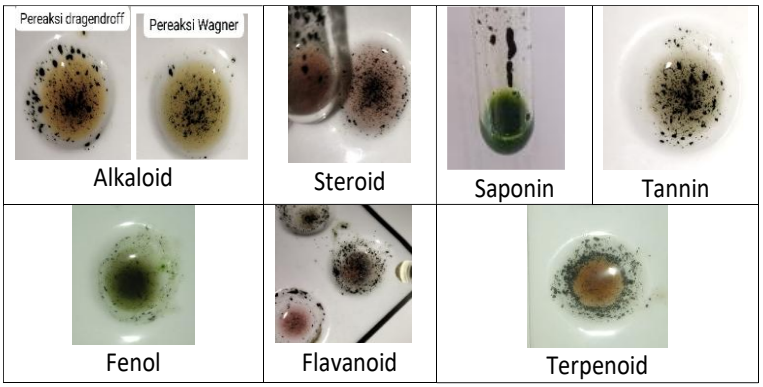

Figure 3. Results of Phytochemical Tests of the Ethanolic Extract of Gatal Leaves

Phytochemical screening of the Gatal leaf extract reveals that phenols and flavonoids are the primary compounds responsible for its strong antioxidant activity. Both of these compound classes are capable of neutralizing free radicals, thereby protecting cells and tissues from oxidative damage a key factor in the development of various degenerative diseases, including cancer and cardiovascular disorders. Furthermore, flavonoids exhibit effective anti-inflammatory activity, helping to reduce chronic inflammation and protect organs from damage caused by prolonged inflammatory processes. The chemical reactions involved in the secondary metabolite tests can be seen in Figure 4.

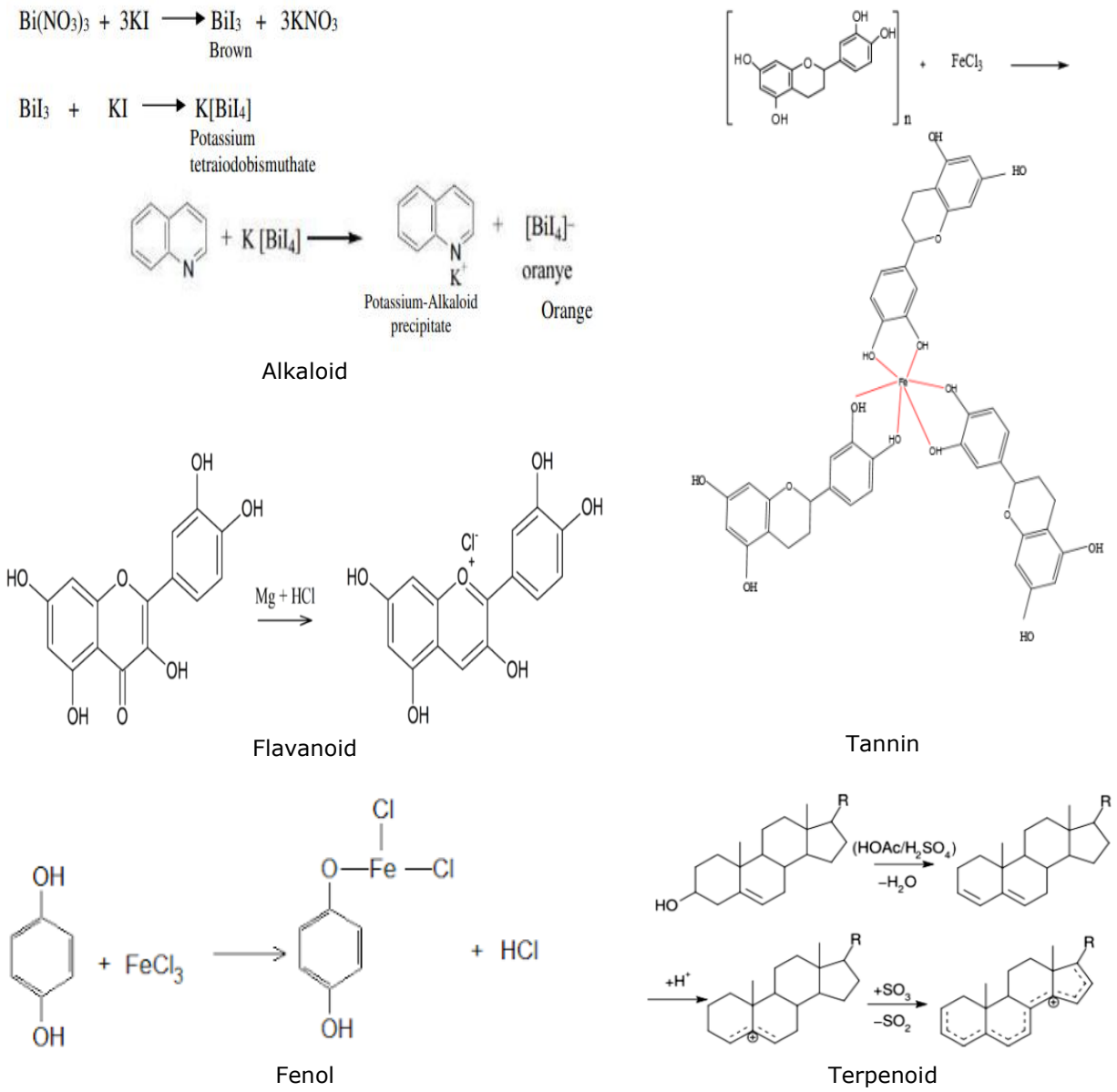

Figure 4. Chemical reaction of phytochemical test

The presence of alkaloids in the extract enhances its potential antimicrobial and analgesic properties, consistent with the traditional use of Gatal leaves to treat infections and relieve pain. Tannins act as astringents, strengthening tissues and inhibiting the growth of pathogenic microorganisms, thus complementing the extract's therapeutic effects. Additionally, the detected terpenoids add further pharmacological value, as they are well known for their anticancer, antiviral, and immunomodulatory activities—potentially strengthening the body's immune response and opening new avenues for plant-based drug development.

Environmental factors such as geographical location, climate, temperature, humidity, and soil quality significantly influence the biosynthesis and concentration of phytochemicals in Gatal leaves. Therefore, collecting samples from diverse locations is essential to obtain a representative chemical profile. The qualitative phytochemical screening method employed provides a valuable initial indication but is limited in structural identification and compound quantification. To strengthen the scientific foundation, future research should employ advanced techniques such as chromatography and spectroscopy (e.g., HPLC, GC-MS, NMR). These methods will enable precise identification of active compounds, accurate measurement of their relative concentrations, and a deeper understanding of their pharmacological mechanisms. Such an approach will support the development of Gatal leaf extract into an effective, high-competitive herbal drug ingredient.

Determination of Antioxidant Activity (IC_{50})

The antioxidant activity of the *Gatal* leaf extract was examined using the DPPH method, with the IC_{50} value determined as an indicator of free-radical scavenging ability. The IC_{50} (Inhibitory Concentration 50 %) is the concentration of extract required to inhibit 50 % of DPPH radicals. A smaller IC_{50} value indicates a more effective extract in suppressing free radicals, and thus a stronger antioxidant activity. If the IC_{50} of the obtained extract is less than 50 ppm, the extract is categorized as a very strong antioxidant (Molyneux, 2004).

Table 2. Calculation of Percent Inhibition and IC_{50}

Concentration (ppm)	**ln Concentration**	**Mean Absorbance**	**Absorbance** Sample	**% Inhibition**	**IC_{50}**
20	3,00	0,38	0,30	19,84	
40	3,69	0,42	0,23	37,50	
60	4,09	0,57	0,19	48,37	
80	4,38	0,48	0,15	59,24	55,31
100	4,61	0,88	0,12	67,39	

The IC_{50} values for the *Gatal* leaf extract solution and vitamin C (used as a reference) were obtained by constructing a linear regression curve (% inhibition vs. ln concentration) based on Table 2 and calculating IC_{50} using the equation **y = bx + a**. The IC_{50} values for each test solution can be seen in **Figure 5**.

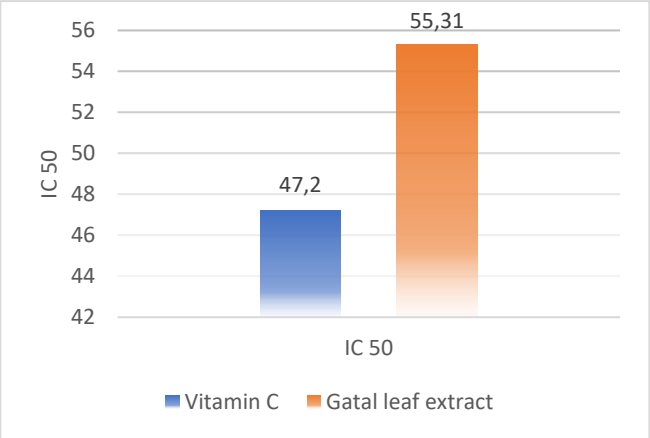

Figure 5. Antioxidant Activity Values of *Gatal* Leaf Extract and Vitamin C

According to the antioxidant classification introduced by Blois (1958), the IC_{50} value serves as the primary parameter for assessing the potency of a substance in neutralizing free radicals; the lower the IC_{50}, the higher the antioxidant activity. In this experiment, the reference standard vitamin C exhibited an IC_{50} of 47.20 ppm, indicating a very strong antioxidant potential. The ethanol extract of *Gatal* leaves yielded an IC_{50} of 55.31 ppm, which still falls within the strong antioxidant category because it is only slightly higher than the standard. This indicates that the extract is nearly comparable to vitamin C in its ability to scavenge free radicals, making it a promising source of natural antioxidants.

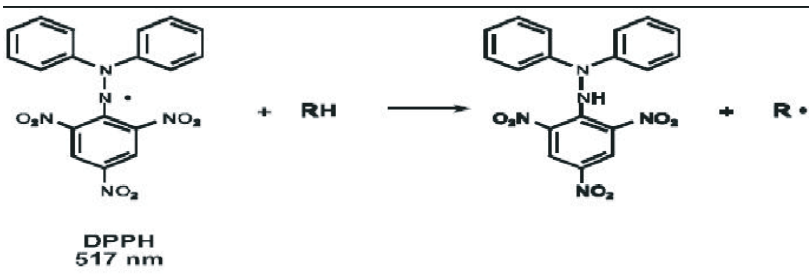

Figure 6. Mechanism of chemical reaction for antioxidant test using DPPH method

This minor difference may be influenced by variations in phytochemical composition (e.g., phenols, flavonoids, terpenoids), which depend on environmental factors such as nutrition, light, salinity, humidity, and temperature will affect the content of secondary metabolites (Wuriana et al, 2020) and extraction procedures. Therefore, these results not only reinforce the pharmacological potential of *Gatal* leaves but also open opportunities for developing nutraceuticals or food-grade additives that could replace or complement vitamin C as an antioxidant agent.

4. Conclusion

The ethanol extract of *Gatal* leaves showed positive results in phytochemical screening for phenols, flavonoids, alkaloids, tannins, and terpenoids, while saponins and steroids were not detected. Phenols and flavonoids are the primary compounds responsible for the antioxidant activity, while alkaloids, tannins, and terpenoids contribute to additional pharmacological properties. Antioxidant activity evaluated using the DPPH method yielded an IC_{50} value of 55.31 ppm, which is only slightly higher than the vitamin C standard (IC_{50} = 47.20 ppm), indicating that the extract possesses strong free-radical scavenging ability and is nearly comparable to vitamin C.

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