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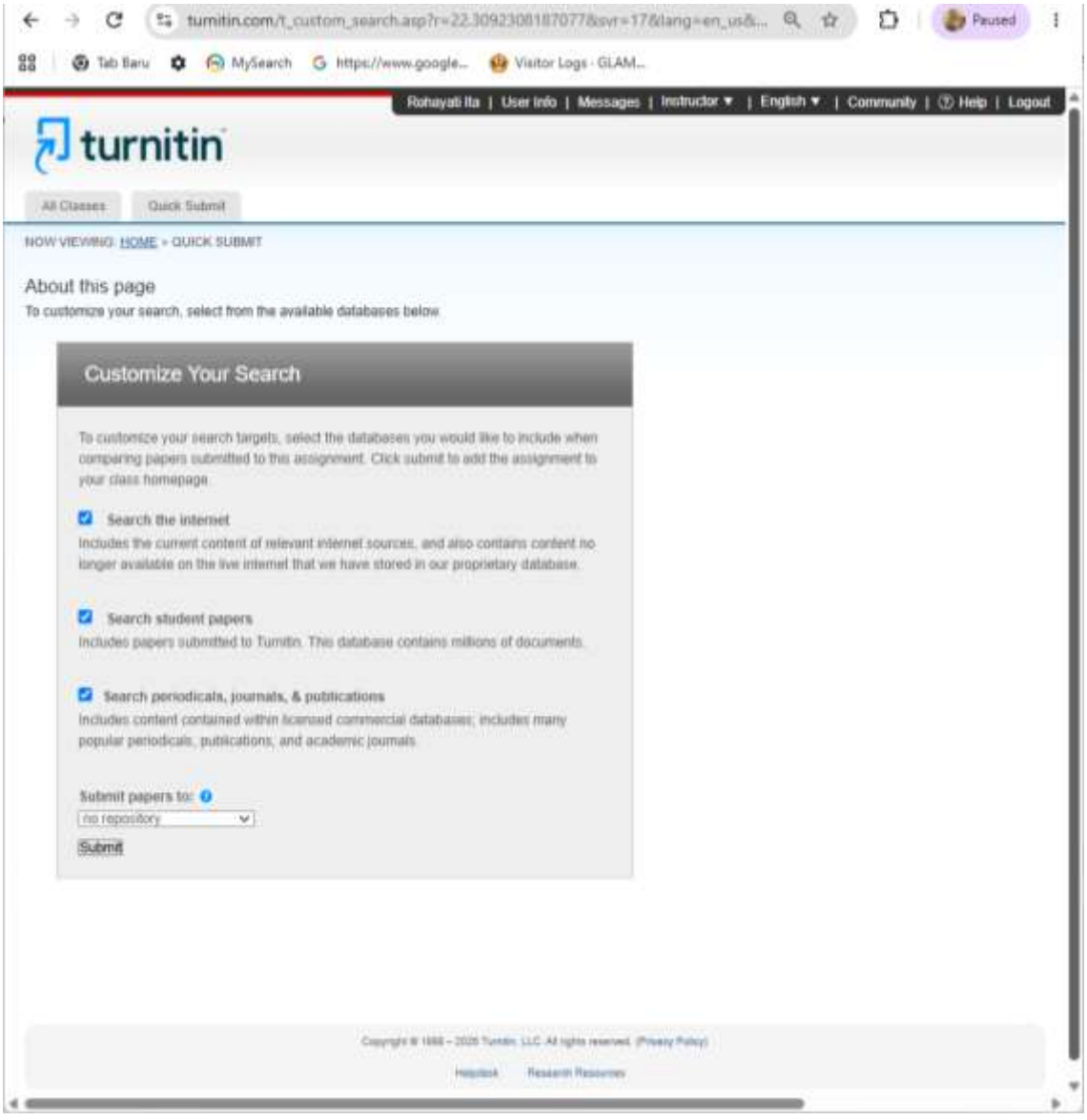
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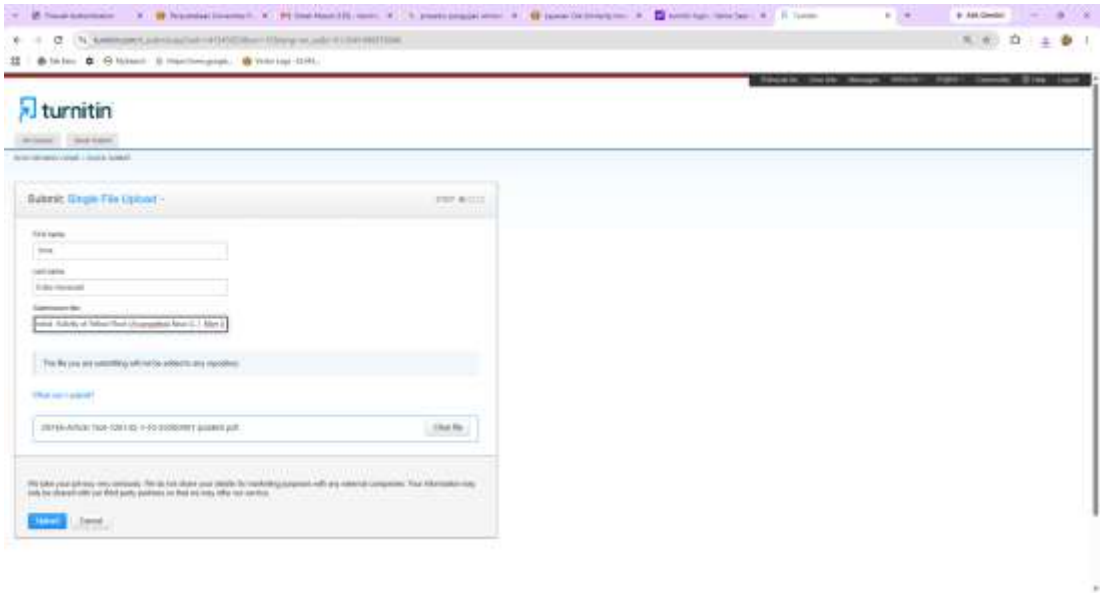
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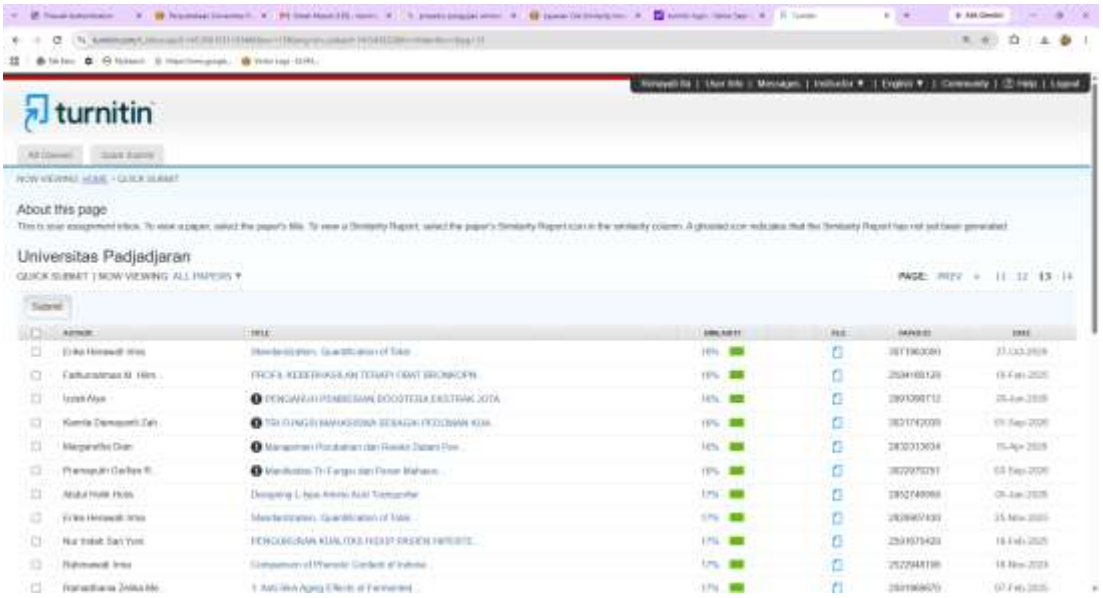


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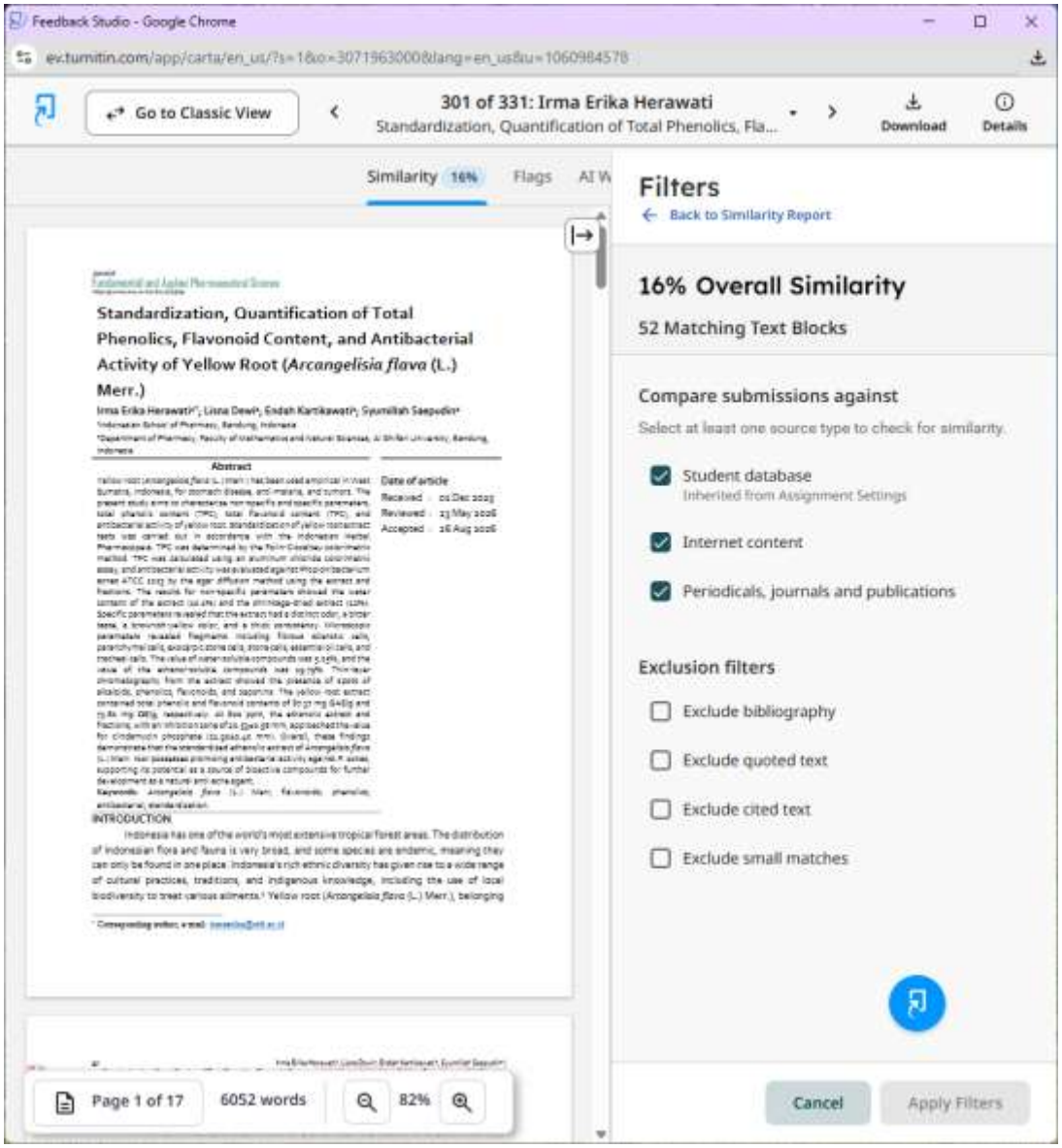
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Standardization, Quantification of Total Phenolics, Flavonoid Content, and Antibacterial Activity of Yellow Root (*Arcangelisia flava* (L.) Merr.)

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Abstract

Yellow root (*Arcangelisia flava* (L.) Merr.) has been used empirical in West Sumatra, Indonesia, for stomach disease, anti-malaria, and tumors. The present study aims to characterize non-specific and specific parameters, total phenolic content (TPC), total flavonoid content (TFC), and antibacterial activity of yellow root. Standardization of yellow root extract tests was carried out in accordance with the Indonesian Herbal Pharmacopeia. TPC was determined by the Folin-Ciocalteu colorimetric method. TFC was calculated using an aluminum chloride colorimetric assay, and antibacterial activity was evaluated against Propionibacterium acnes ATCC 1223 by the agar diffusion method using the extract and fractions. The results for non-specific parameters showed the water content of the extract (10.1%) and the shrinkage-dried extract (12%). Specific parameters revealed that the extract had a distinct odor, a bitter taste, a brownish-yellow color, and a thick consistency. Microscopic parameters revealed fragments including fibrous sclerotic cells, parenchymal cells, exocarpic stone cells, stone cells, essential oil cells, and tracheal cells. The value of water-soluble compounds was 5.25%, and the value of the ethanol-soluble compounds was 19.75%. Thin-layer chromatography from the extract showed the presence of spots of alkaloids, phenolics, flavonoids, and saponins. The yellow root extract contained total phenolic and flavonoid contents of 87.37 mg GAE/g and 73.80 mg QE/g, respectively. At 800 ppm, the ethanolic extract and fractions, with an inhibition zone of 20.53±0.58 mm, approached the value for clindamycin phosphate (21.90±0.40 mm). Overall, these findings demonstrate that the standardized ethanolic extract of *Arcangelisia flava* (L.) Merr. roor possesses promising antibacterial activity against *P. acnes*, supporting its potential as a source of bioactive compounds for further development as a natural anti-acne agent.

Keywords: *Arcangelisia flava* (L.) Merr; flavonoids; phenolics; antibacterial; standardization.

Date of article

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INTRODUCTION

Indonesia has one of the world's most extensive tropical forest areas. The distribution of Indonesian flora and fauna is very broad, and some species are endemic, meaning they can only be found in one place. Indonesia's rich ethnic diversity has given rise to a wide range of cultural practices, traditions, and indigenous knowledge, including the use of local biodiversity to treat various ailments.[1] Yellow root (*Arcangelisia flava* (L.) Merr.), belonging

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to the family Menispermaceae, is one of the therapeutic plants studied in this study. Yellow root is used to treat jaundice, inflammation, malaria and cancer.[1–3]

To maintain their qualities, medicinal plants require procedures to prove identity, purity, and quality. Herbal medicine standardization entails confirming its identity and determining its quality and purity. Because of advances in the chemical understanding of crude drugs, many methods, such as botanical, chemical, spectroscopic, and biological methods, are currently employed to estimate the active ingredients present in crude medications, in addition to physical constants.[4]

Numerous studies have been conducted on yellow root, particularly pharmacological activity tests, but standardization of yellow root has not been conducted.[5] Previous studies have demonstrated various pharmacological properties of *Arcangelisia flava* (L.) Merr., including antimicrobial activity. More specifically, a previous study reported that polarity-based fractions of *A. flava* inhibited the growth of *Propionibacterium acnes*. However, that study mainly focused on antibacterial screening of the fractions. It did not integrate the antibacterial findings with comprehensive quality standardization of the plant material and extract, quantitative determination of total phenolic and flavonoid contents, and direct comparison between the crude extract and its fractions.[6]

Therefore, the relationships among the standardized quality characteristics, phytochemical content, and antibacterial activity of *A. flava* root extract against acne-associated bacteria remain insufficiently characterized. This represents an important research gap because standardization is essential to ensure the identity, consistency, and reproducibility of medicinal plant extracts intended for further pharmaceutical development.

Propionibacterium acnes was selected as the test organism because it plays an important role in inflammatory acne through its interactions with the pilosebaceous unit and the host inflammatory response. Moreover, increasing antibiotic resistance *in P. acnes*, particularly to clindamycin and macrolides commonly used to treat acne, has become a significant therapeutic concern.[7] Recent clinical studies have also demonstrated that *P. acnes* isolates can form biofilms and have reported substantial resistance to commonly used anti-acne antibiotics.[8] These problems reinforce the need to explore plant-derived antibacterial compounds as potential complementary agents for anti-acne.

The selection of *A. flava* is also of phytochemical relevance. Recent chemical investigations have identified several alkaloidal constituents in this plant, including berberine, jatrorrhizine, and palmatine.[9] Of particular interest, berberine has recently been demonstrated to exert direct antibacterial activity against *P. acnes*, with reported MIC and MBC values of 6.25–12.5 µg/mL and 12.5–25 µg/mL, respectively. Its antibacterial action was associated with disruption of the bacterial cell wall and membrane, and with alterations in genes involved in peptidoglycan synthesis.[10] Accordingly, evaluating the standardized *A. flava* root extract and its fractions against *P. acnes* provides a rational approach for linking the extract's phytochemical characteristics and quality parameters to its potential biological activity.

METHODS

Materials

Arcangelisia flava radix (yellow root) was collected from Perum Perhutani Pontianak, Southeast Pontianak, Kubu Raya District, West Kalimantan in April 2021. The plant was identified by the Plant Taxonomy Laboratory, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Indonesia, with No. No.21/HB/03/2021, which stated that the plant used was *Arcangelisia flava* (L.) Merr. Methanol, ethanol, hydrochloride acid, acetic acid, sodium hydroxide, sodium ferric chloride, magnesium powder, aluminum chloride and Silica gel F254 purchased from Merck (Germany). Gallic acid, quercetin caffein was purchased from Sigma Aldrich (USA). Propionibacterium ATCC 1223 was obtained from the Microbiology Laboratory, Padjadjaran University. Analytical-grade sulfuric acid, barium chloride, and dimethyl sulfoxide were purchased from Sigma-Aldrich (Germany), and bacteriology-grade Mueller–Hinton agar (MHA) was purchased from Oxoid (UK).

Determination

The plant was identified by the Plant Taxonomy Laboratory, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Indonesia, with No. No.21/HB/03/2021, which stated that the plant used was *Arcangelisia flava* (L.) Merr.

Extraction

Yellow root was extracted by maceration in 70% ethanol for 4 x 24 hours, with the solvent replaced every 24 hours. The extracts were concentrated using a rotary evaporator at 40–50 °C until a constant weight was obtained, after which the yield was calculated.[5]

Fractionation

The viscous ethanolic extract (10 g) was mixed with distilled water to obtain a final solution volume of 100 mL. This solution underwent triple liquid–liquid extraction using both n-hexane and ethyl acetate. All extracts were then collected and evaporated.[11]

Shrinkage drying measurement

To determine drying shrinkage, 1 g of extract was introduced into a closed weighing bottle that had previously been conditioned by heating and weighed. The sample was then oven-dried at 105 °C with the bottle's lid removed. Following heating, the bottle was placed in a desiccator to allow it to return to ambient temperature. This cycle was repeated until a constant mass was recorded, with a weight variation of less than 0.0005 g between successive measurements.[12]

Water content

The extract (3 g) was wrapped in aluminum foil and put in a dry round-bottom flask. Fifty mL of toluene was added to the flask through a cooler (vertical condenser), and the mixture was heated carefully for 60 minutes. Toluene was used to rinse the inside of the condenser, and the setup was left undisturbed until distinct toluene and water layers formed. The amount of the water layer was then recorded.[12]

Extract identity and organoleptic evaluation of extracts

The extract identity included nomenclature description, the plant's other names, including the Indonesian name, as well as the plant's parts used. The organoleptic properties evaluated included the extract's color, smell, and taste.[12]

Microscopic identification

The powdered yellow root was positioned on a microscope slide and treated with chloral hydrate. After covering it with a coverslip, the preparation was gently heated over a Bunsen burner with tube clamps to avoid boiling. Once dried, the slide was observed under a microscope at 10x magnification.[13]

Identification of compounds that are soluble in specific solvents

Two samples of yellow root extract (1.5 g each) were weighed and designated as Extract 1 and Extract 2. Extract 1 underwent 24-hour maceration in a stoppered flask with water–chloroform mixture (50 mL), whereas Extract 2 was macerated using 50 mL of 96% ethanol. Following filtration, 10.0 mL of each extract was placed in a pre-weighed container and evaporated. The residue was then dried in an oven at 105 °C until a stable weight was reached.[12]

Phytochemical screening

The identification of chemical components in yellow root ethanol extract involved phytochemical testing for the presence of flavonoids, alkaloids, tannins, saponins, steroids, triterpenoids, and glycosides.[14]

Alkaloid test

On a porcelain cup, 100 mg of simplicia and viscous extract were placed. After that, samples were dissolved in 5 mL of 2 M. The solution obtained was divided into two test tubes. As a blank, three drops of HCl 2 M were added to the first tube. Three drops of Dragendorff reagent were added to the second tube. The Dragendorff reagent would form orange deposits.

Phenolic test

On test tube, 100 mg of simplicia and viscous extract were placed. 5 mL of hot water was added. The samples were filtered up, and a few drops of a 10% iron (III) chloride solution were added. The presence of tannins was indicated by a dark blue or greenish-black color.

Flavonoids test

On test tube, 100 mg of simplicia and viscous extract were placed. 5 mL of hot water was added. The samples were filtered up, and 0.05 mg of Mg powder and 1 mL of concentrated HCl were added, and the mixture was then vigorously shaken. Positive tests produced red, yellow, or orange colors.

Tannin test

On test tube, 100 mg of simplicia and viscous extract were placed. 5 mL of hot water was added. The samples were filtered up, and 1 mL of 1 % gelatine solution was added. The presence of tannins was indicated by white precipitate.

Saponin test

On test tube, 100 mg of simplicia and viscous extract were placed. 5 mL of hot water was added. The samples were filtered up, then follow with 5 mL of water. The test tube was then vigorously shaken for 10 seconds, and 1 drop of 2 N HCl was added. A positive test formed a stable froth that reached a height of 1-10 cm and remained stable for at least 10 minutes.

Steroid test

On test tube, 100 mg of simplicia and viscous extract were placed. 5 mL of ether was added. The samples were filtered up, with two drops of glacial CH_3COOH added. The solution was gently shaken and set aside for a few minutes. Blue or green indicated steroids.

Glycosides test

On test tube, 100 mg of simplicia and viscous extract were placed. 5 mL of ethanol was added following evaporating. The residue was added 1 mL of glacial CH_3COOH and 10 drops of concentrated H_2SO_4. Blue or green indicated steroids.

Chromatogram profile

To separate different phytochemicals from the ethanol extract of yellow root, the sample was manually applied with a capillary tube onto silica gel GF254 plates (15 x 5 cm, 3 mm thick). The plates were then placed in a mobile phase system.[13] After Thin-Layer Chromatography (TLC) development, specific visualization reagents (Dragendorff's and 5% ferric chloride) were sprayed onto the plates to detect alkaloids and phenolics, respectively.[15] The developed spot colors were noted, and the Rf values were calculated using formula 1:[15]

$$\text{Retention factor (Rf)} = \frac{distance\ travelled\ by\ the\ solute}{distance\ travelled\ by\ the\ solvent} \quad 1$$

Table 1. Determination of phytochemicals in yellow root extract with suitable mobile phases through TLC

Compounds	Mobile Phases	Spraying Reagents	Color of the spot
Alkaloids	Chloroform: Methanol (3:2)	Dragendorff	Orange/ Brown
Polyphenols	Chloroform: Methanol (7: 3)	$FeCl_3$	Blackish blue
Flavonoids	Ethyl acetate: Methanol: Water: Glacial acetic acid (1.7: 0.5: 0.5: 0.5)	$FeCl_3$	Grey
Saponins	Chloroform: Methanol (2.2: 0.5)	Vanillin H_2SO_4 reagent	Violet Blue

Total phenolics content (TPC)

To evaluate the total phenolics, the Folin-Ciocalteu technique according to Hanifah et al. (2020) with modifications was used.[16] The test sample (2500 ppm in 70% ethanol) was mixed with 5 mL of the Folin-Ciocalteu reagent (diluted 1:10 with distilled water) and 4 mL of 1M sodium carbonate. After 15 minutes of incubation, the absorbance was recorded at 776.5 nm. The absorbance of the samples was calculated using a standard curve obtained by

linear regression. The total phenolic content was expressed as mg GAE/g using the following formula.[2]

$$TPC\ (mg\ GAE/g) = \frac{c\ x\ v\ x\ fp}{g} \quad (2)$$

Description:

TPC : Total Phenolic Content (mg GAE/g)
c : concentration of gallic acid compound (mg/L)
v : volume of the sample used (L)
fp : dilution factor
g : weight of the sample (g)

Total flavonoid content (TFC)

The determination of flavonoid content was done using Chang et al.'s (2020) method with modifications.[17] The sample was prepared at a concentration of 5000 ppm using 70% ethanol. An aliquot of 0.5 mL of the sample was added to a test tube containing 1.5 mL of 70% ethanol. Subsequently, 0.1 mL of 10% aluminum chloride, 0.1 mL of 1 M sodium acetate, and 2.8 mL of distilled water were added. The mixture was incubated at room temperature for 30 minutes. Absorbance was then measured at 435.5 nm using a UV-Vis spectrophotometer.

The absorbance of the samples was calculated using a standard curve obtained by linear regression. The total flavonoid content was expressed in mg QE/g using the following formula 3.

$$TFC\ (mg\ QE/g) = \frac{c\ x\ v\ x\ fp}{g} \quad (3)$$

Description:

TPC : Total Flavonoid Content (mg QE/g)
c : concentration of quercetin compound (mg/L)
v : volume of the sample used (L)
fp : dilution factor
g : weight of the sample (g)

Preparation for *P. acnes* Culture

P. acnes ATCC 1223 pure culture was inoculated onto a slant MHA medium and incubated for 24 hours at 37 °C. The bacterial colonies were then suspended in 5 mL of sterile 0.9% NaCl solution. The turbidity of the bacterial suspension was standardized to the 0.5 McFarland scale, corresponding to 1.5 × 10^8 CFU/mL. The 0.5 McFarland standard was

created by mixing 1.175% barium chloride with 1% sulfuric acid in a volumetric ratio of 0.05 to 9.95.(13)

Antibacterial Activity Assay

A petri dish containing Mueller-Hinton Agar (MHA) was inoculated with 20 µL of the bacterial suspension and left to solidify. A perforator (6 mm diameter) was used to make wells in the agar. For each well, 50 µL of solution was added: 10% clindamycin phosphate as the positive control, 1% DMSO as the negative control, and the experimental groups included plant extract, water, ethyl acetate, and n-hexane fractions at concentrations of 800 ppm and 600 ppm. The culture plates were incubated for 18–24 hours at 37 °C, and the sizes of the inhibition zones were measured with a caliper.[13]

RESULTS AND DISCUSSION

From 1.5 kg of dried yellow root, a total of 151.86 g of concentrated extract was obtained, resulting in a yield of 10.12%. The appearance of yellow root simplicia and its powdered form is shown in Figure 1.



Figure 1. (a) Yellow Root



Figure 1. (b) Dried Yellow Root

Maceration is an extraction technique in which the sample is soaked in a solvent (menstruum) until fully immersed. After extraction, the solution (micelle) is separated from the solid residue (marc) through filtration. Evaporation is then used to remove the micelle from the menstruum.[19] This technique was chosen to protect thermolabile chemicals while also adhering to the Indonesian herbal pharmacopeia.[13] Ethanol was chosen because it is polar, miscible with water, nontoxic at low concentrations, and requires only a modest quantity of heat to concentrate the extract.(1) The extract yield from this research was 10.12%. In this study, the separation funnel method was used to separate the components in the extract. The solvents used for fractionation were *n*-hexane, ethyl acetate, and water. Those fractions were used to analyze antibacterial activity. The yield of each fraction is shown in Table 2.

Table 2. Yield Fraction from Yellow Root Extract

Fraction	Yield (%)
n-hexane	2.075
Ethyl acetate	5.075
Water	81.025

The fraction yield did not reach 100%, likely because the natural raw material contained various structural components and metabolites. Only certain active compounds were dissolved, while the dregs (such as fiber and complex carbohydrates) were left behind or discarded.[20]

This study examined non-specific factors, such as shrinkage, drying and moisture measurements of simplicia and extracts. The drying shrinkage measurement provides insight into the amount of compounds that may be lost throughout the drying procedure. Meanwhile, the water content of simplicia and extract is related to their quality and storage capacity. The water content and shrinkage drying of simplicia did not exceed 10%, but the water content ranged from 5-30% in the thick extract category. Thus, according to Table 3, both simplicia and extract met the Indonesian Herbal Pharmacopeia criteria.

Table 3. The Characterization of Non-Specific Parameters from Yellow Root

Parameters	Results (%)	
	Simplicia	Extract
Shrinkage drying	3.0	12.0
Water content	3.8	10.1

To objectively confirm the identity of a material, specific parameters, such as extract identification and organoleptic evaluation, must be assessed. The parameter must be determined in order to provide an objective identity from the compound's name and specific identity. The organoleptic properties of yellow root ethanolic extract were evaluated. The yellow root plant has not been included in the Indonesian herbal pharmacopeia, so the

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determination of specific and non-specific parameters was carried out solely on the basis of researchers' observations. The results of the form, color, smell, and taste tests are shown in Table 4.

Table 4. The Characterization of Specific Parameters from Yellow Root Extract

Parameters	Characteristics
Identity	
Scientific name for plants	*Arcangelisia flava* L. (Merr)
Used parts	Radix
Indonesian name plants	Akar kuning (Yellow root)
Organoleptic	
Form	Thick
Color	Brownish-yellow
Smell	Specific
Taste	Bitter

The purpose of assessing dissolved compound levels was to estimate the amount of compounds that could be extracted using particular solvents. Water primarily dissolves polar molecules, while ethanol is effective for solubilizing both semi-polar and non-polar compounds.[21] Yellow root is more soluble in water than in ethanol, as seen in Table 5. According to these observations, the compounds detected in the yellow root extract were polar. This result was consistent with the fractionation results as seen in Table 2 previously.

Table 5. Parameters Levels of Dissolved Compounds in Specific Solvents

Parameter	Characteristics
Soluble ethanol compounds	5.25%
Soluble water compounds	19.75%

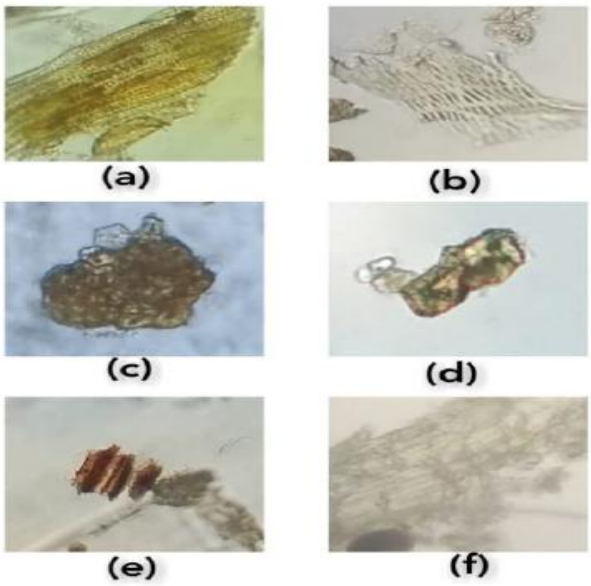


Figure 2. Microscopic from yellow root powder fragments: (a) fibrous sclerotic cells; (b) parenchymal cells; (c) exocarpic stone cells; (d) stone cells; (e) essential oil cells; and (f) tracheal cells

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The purpose of using a microscope to examine the yellow root powder was to determine the properties of the herb-identification fragments. The chloral hydrate solution is intended to remove cell components such as proteins and starch, allowing cell-entification fragments on the herbs to be clearly visible under a microscope.[22] Figure 2 illustrates the presence of fibrous sclerotic cells, parenchymal cells, exocarpic stone cells, stone cells, essential oil cells, and tracheal cells in the yellow root.

Moreover, Table 6 shows the results of the phytochemical screening. Phytochemical screening not only reveals the components of plant extracts and which ones predominate, but it also aids in the search for chemical compounds that can be used in the development of powerful pharmaceuticals. During phytochemical screening, the color or changes resulting from reactions with specific reagents were observed qualitatively. This screening aimed to detect and characterize secondary metabolite constituents within the simplicia and extracts.

Secondary metabolites are present in medicinal plants, and alkaloids, flavonoids, glycosides, saponins, and terpenoids are among the bioactive substances.[23] The chromatographic method is widely used for isolating components from plants. Thin-layer chromatography (TLC) was used to identify secondary metabolites, including alkaloids, phenolics, flavonoids, and saponins, in the yellow root ethanolic extract. Various mobile phase formulations were tested (see Table 1), and the samples were spotted onto TLC plates for analysis. Following derivatization with specific spraying reagents, color development was observed, indicating the presence of alkaloids, phenolics, flavonoids, and saponins. These compounds exhibited varying Rf values across different solvent systems in the TLC analysis of ethanolic yellow root extract (Figure 3).

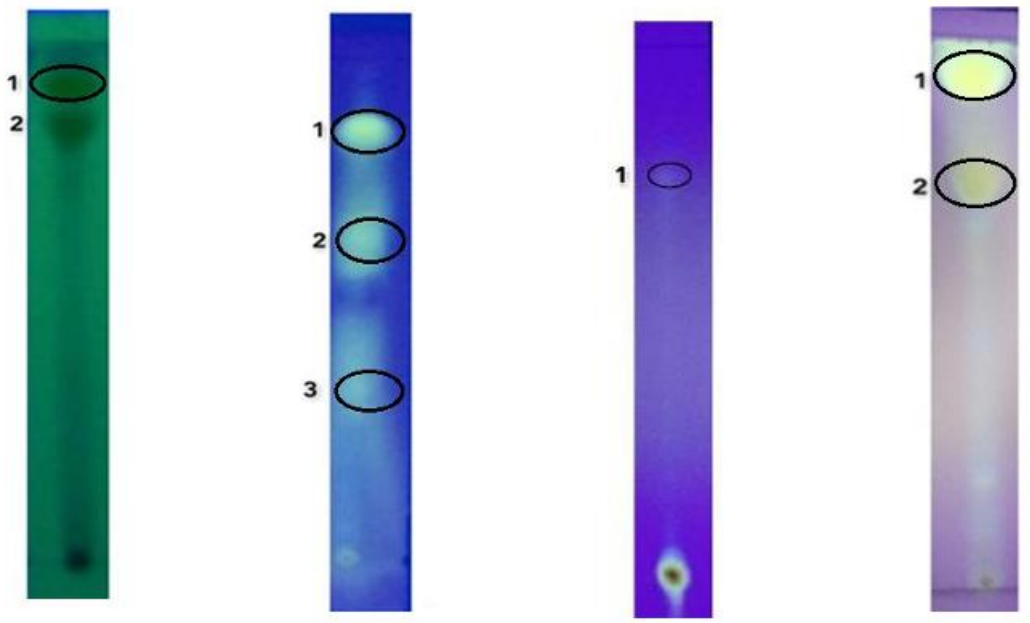
Table 6. Results of Identification of Bioactive Compounds from Yellow Root

Phytochemical Test	Simplicia	Extract
Alkaloids	+	+
Phenolics	+	+
Flavonoids	+	+
Tannins	-	-
Saponins	+	+
Steroids	-	-
Glycosides	-	-

*(+) = positive test (exist); (-) = negative test (not exist)

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Alkaloids
Spot 1: Rf = 0.88
(Alkaloids 1)
Spot 2: Rf = 0.78
(Alkaloids 2)

Polyphenols
Spot 1: Rf = 0.85
(Polyphenols 1)
Spot 2: Rf = 0.57
(Polyphenols 2)
Spot 3: Rf = 0.37
(Polyphenols 3)

Flavonoids
Spot 1: Rf = 0.75
(Flavonoids 1)

Saponins
Spot 1: Rf = 0.80
(Saponins 1)
Spot 2: Rf = 0.60
(Saponins 2)

Figure 3. Rf Values of Yellow Root Extract

Table 7. Rf Value of Yellow Root Extract on Various Secondary Metabolites

Metabolites	Number of Spots	Rf Value
Alkaloids	1	0.88
	2	0.78
Polyphenols	1	0.85
	2	0.57
	3	0.37
Flavonoids	1	0.75
Saponins	1	0.80
	2	0.60

Total phenolic content (TPC) is frequently determined using the Folin-Ciocalteu assay, a well-established analytical technique. Since high phenolic levels are often associated with strong antioxidant activity, this assay plays a key role in assessing overall antioxidant potential. The Folin-Ciocalteu reaction involves electron transfer from phenolic compounds and other reductants to phosphomolybdic-phosphotungstic acid complexes, forming a blue complex with peak absorbance (λmax) between 700 and 800 nm. As a result, the absorption spectra of.[24] The calibration curve for acid gallic was obtained from the study data, as shown in Figure 4. Using the gallic acid calibration curve with the linear regression model y = 0.0857x

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+ 0.2997 (R^2 = 0.9945), the total phenolic content (TPC) of yellow root extract was determined to be 2.280 mg gallic acid equivalents (GAE) per gram of dried extract (Table 7).

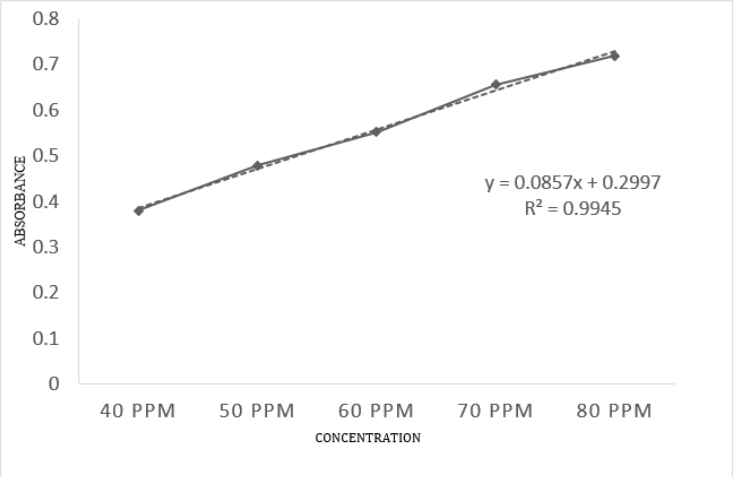


Figure 4. Calibration Curve of Gallic Acid (n=3)

Table 7. Results of TPC on Yellow Root Extract

Sample	Replication	Concentration (ppm)	Absorbance	Total Phenolics Content (mg GAE/g)	Average of Total Phenolics Content (mg GAE/g)±SD
Extract	1	2500	0.317	2.523	2.280±0.971
	2		0.321	3.107	
	3		0.308	1.211	

Total flavonoid content (TFC) was determined using a colorimetric method with quercetin as the reference flavonoid.[25] TFC in the extracts was calculated from the calibration curve regression equation (y=0.0753x+0.0082; R2=0.997), as shown in Figure 5, and expressed as mg quercetin equivalents (QE) per gram of sample dry weight (mg/g). The absorption of quercetin was measured at a maximum wavelength of 435 nm. The flavonoid concentration of the leaf extract was determined to be 71.071 mg QE/g, as indicated in Table 8.

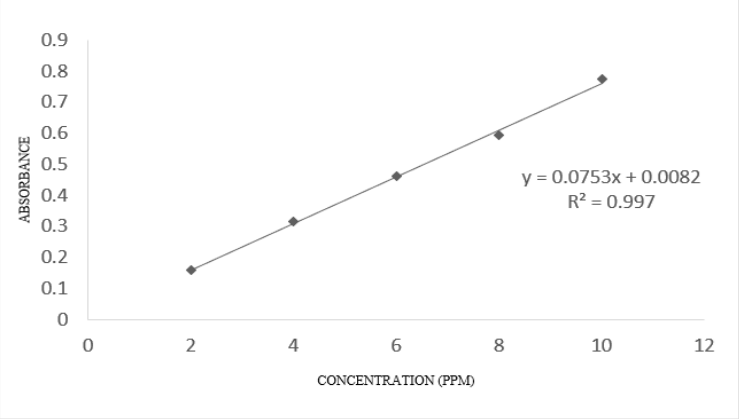


Figure 5. Calibration Curve of Quercetin (n=3)

Table 8. Results of TFC on Yellow Root Extract

Sample	Replication	Concentration (ppm)	Absorbance	Flavonoids content (mg QE/g)	Average Flavonoids content (mg QE/g)±SD
Extract	1	2500	0.438	71.348	71.071±0.253
	2		0.436	71.016	
	3		0.435	70.850	

Clindamycin phosphate, employed in this study as a positive control, is approved by the U.S. Food and Drug Administration for treating conditions such as sepsis, intra-abdominal and lower respiratory tract infections, gynecological infections, and infections of the skin, bones, and joints. The antibiotic may exhibit bacteriostatic or bactericidal properties, depending on the organism, site of infection, and concentration. The predominant bacteria in the pilosebaceous unit of normal human skin are *P. acnes*, a Gram-positive anaerobic bacterium. *P. acnes* is linked to several disorders, including skin diseases, and is the most frequent source of opportunistic infections, such as acne vulgaris.[13]

The antibacterial activity results showed a clear concentration-dependent trend for the ethanolic extract and all yellow root fractions. At 800 ppm, the ethanolic extract produced the largest inhibition zone (20.53 ± 0.58 mm), followed by the water fraction (18.60 ± 0.20 mm), ethyl acetate fraction (15.93 ± 0.35 mm), and n-hexane fraction (14.83 ± 0.50 mm). At 600 ppm, the same order of antibacterial activity was observed, with inhibition zones of 18.90 ± 0.62, 17.16 ± 0.66, 14.46 ± 0.66, and 13.26 ± 0.05 mm, respectively. These findings indicate that increasing sample concentration increases the amount of antibacterial constituents available to interact with the bacterial cells, resulting in a larger growth-inhibition zone.

Interestingly, the crude ethanolic extract exhibited greater antibacterial activity than each fraction. Although fractionation is frequently performed to enrich compounds by polarity, it does not necessarily yield greater biological activity. The higher activity of the crude extract observed in this study may indicate additive or synergistic interactions among several classes of secondary metabolites that remain together in the unfractionated extract. In contrast, liquid–liquid partitioning may separate complementary bioactive compounds into different fractions or reduce the concentration of individual active constituents due to incomplete recovery during fractionation. Therefore, the antibacterial effect of *A. flava* may not depend on a single fraction or compound but rather on the combined contribution of multiple constituents.

Among the fractions, the water fraction showed the strongest activity, reaching an inhibition zone of 18.60 ± 0.20 mm at 800 ppm. This finding suggests that relatively polar constituents may contribute substantially to the antibacterial effect of the extract. This interpretation is consistent with the phytochemical screening in the present study, which detected alkaloids, phenolics, flavonoids, and saponins in the ethanolic extract. Nevertheless, because individual compounds were not isolated and quantitatively correlated

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with antibacterial activity in the present investigation, the activity cannot be conclusively attributed to any specific compound.

The antibacterial activity may partly be associated with protoberberine-type alkaloids reported in *A. flava*, particularly berberine.[9] Recent experimental evidence demonstrated that berberine inhibited several *P. acnes* strains, with MIC and MBC values ranging from 6.25–12.5 µg/mL and 12.5–25 µg/mL, respectively.[10] Berberine treatment caused morphological alterations in *P. acnes,* increased leakage of intracellular components, and affected genes involved in peptidoglycan biosynthesis, suggesting that disruption of bacterial cell wall and membrane integrity may be a possible antibacterial mechanism.[10] These findings provide a plausible mechanistic basis for the antibacterial activity observed for the yellow root extract. However, further chemical profiling and activity-guided isolation are required to determine which constituents contribute most strongly to the observed effect.

The ethanolic extract at 800 ppm produced an inhibition zone of 20.53 ± 0.58 mm, which was close to that produced by the clindamycin phosphate positive control (21.90 ± 0.40 mm). However, this comparison should be interpreted cautiously because inhibition-zone diameter is influenced not only by intrinsic antibacterial potency but also by the concentration, molecular size, solubility, and diffusion characteristics of compounds in the agar medium. Therefore, the present results established the antibacterial potential of the extract but did not demonstrate equivalence to clindamycin. Determination of the minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and identification of the major active compounds would be required to characterize its antibacterial potency and mechanism of action more accurately.

Table 9. Antibacterial Activity of Extract and Fractions against *P. acnes* (n = 3)

Sample	Inhibition Zone (mm)±SD	
	Concentration 800 (ppm)	Concentration 600 (ppm)
Ethanol extract	20.53±0.58	18.90±0.62
n-hexane fraction	14.83±0.50	13.26±0.05
Ethyl Acetate fraction	15.93±0.35	14.46±0.66
Water fraction	18.60±0.20	17.16±0.66
Clindamycin phosphate (10%)	21.90±0.40	21.36±0.80

CONCLUSION

This study demonstrated that yellow root extract contained a total phenolic content of 87.37 mg GAE/g and a total flavonoid content of 73.80 mg QE/g. The extract exhibited stronger antibacterial activity against Propionibacterium acnes than its fractions, producing an inhibition zone diameter of 20.23 ± 0.58 mm at 800 ppm. The standardization results indicated that all evaluated parameters of the yellow root extract met the established quality requirements. The extract contained high levels of phenolic and flavonoid compounds, and its antibacterial activity was greater than that of the corresponding fractions.

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Conflict of interest

The authors declare no conflict of interest.

REFERENCES

1. Diliarosta S, Sudarmin S S, Efendi A, Dillasamola D, Oktomalioputri B, Ramadhani R. Reconstruction and Scientific Explanation of Akar Kuning (Arcangelisia flava Merr.) From West Sumatra as Ethnomedicine and Source of Science Learning. Pharmacognosy Journal. 2021 Jan 8;13(1):206–11. https://doi.org/10.5530/pj.2021.13.29
2. Saepudin S, Hidayat TS, Al-Azzahra Y, Cahyati A. Uji Aktivitas Antiinflamasi Ekstrak Batang Akar Kuning (Arcangelisia flava (L.) Merr.) Secara In Vitro. Jurnal Buana Farma. 2024 Mar 26;4(1):1–10. https://doi.org/10.36805/jbf.v4i1.934
3. Tavita GE, Lestari D, Linda R, Apindiati RK, Rafdinal R. Phytochemical Testing and In Vitro Anti-inflammatory Activity on Ethanol Extract of Akar Kuning (Arcangelisia flava L) Stems from West Kalimantan. Jurnal Biologi Tropis. 2022;22(4):1334–9.
4. Sakshi Y. Pathrikar, Vaishnavi S.Mukhmale, Nandakishor B. Deshmukh, Swati P. Deshmukh. Standardization extraction and phytochemical screening for herbal drugs. GSC Advanced Research and Reviews. 2025 Jan 30;22(1):084–91. https://doi.org/10.30574/gscarr.2025.22.1.0518
5. Yabansabra Y, Bowaire A, Simaremare ES, Yaam DY, Tiris A, Nadeak ESM. Phytochemical and Pharmacological Review of Arcangelisia flava (L.) Merr: Insights into Its Bioactive Compounds and Therapeutic Potential. JURNALBIOLOGIPAPUA. 2025;17(1):82–92.
6. Ikwanti D, Perawati S, Andriani L. Uji Aktivitas Antbakteri Fraksi Tumbuhan Bajakah Kuning (Arcangelisia flava (L.) Merr.) Terhadap Propionibacterium acnes. Journal of Syntax Literate. 2023;8(11).
7. Koyanagi S, Koizumi J, Nakase K, Hayashi N, Horiuchi Y, Watanabe K, et al. Increased frequency of clindamycin-resistant *Cutibacterium acnes* strains isolated from Japanese patients with acne vulgaris caused by the prevalence of exogenous resistance genes. J Dermatol. 2023 Jun 7;50(6):793–9. https://doi.org/10.1111/1346-8138.16757
8. Paul NA, Bhat M R, Antony B, Jayaraman J. Antibiotic resistance and biofilm formation in *Cutibacterium acnes* : A descriptive cross-sectional study. Indian J Dermatol Venereol Leprol. 2025 Jan 17;91:315. https://doi.org/10.25259/IJDVL_539_2024
9. Pratama RR, Sari RA, Sholikhah I, Mansor H, Chang HI, Sukardiman, et al. Inhibition of nitric oxide production in RAW 264.7 cells and cytokines IL-1β in osteoarthritis rat models of 70 % ethanol extract of Arcangelisia flava (L.) merr stems. Heliyon. 2024 Aug;10(15):e35730. https://doi.org/10.1016/j.heliyon.2024.e35730

10. Sun L, Yu Q, Peng F, Sun C, Wang D, Pu L, et al. The antibacterial activity of berberine against Cutibacterium acnes: its therapeutic potential in inflammatory acne. Front Microbiol. 2024 Jan 5;14. https://doi.org/10.3389/fmicb.2023.1276383
11. Saptarini NM, Mustarichie R, Herawati IE, Hadisoebroto G. Isolation, Identification, and Quantification of Major Flavonoid In Leaves of Pereskia bleo (Kunth) DC. International Journal of Applied Pharmaceutics. 2022 Nov 26;106–10. https://doi.org/10.22159/ijap.2022.v14s4.PP19
12. Herawati IE, Hanifah HN. Antioxidant activity from ethanol extract and fractions of red flame ivy (Hemigraphis colorata Hall. F.) leaf using 1, 1-diphenyl-2-picrylhydrazyl. Drug Invention Today. 2018;10(5):3791–3.
13. Departemen Kesehatan. Parameter Standar Umum Ekstrak Tumbuhan Obat. 2000. 77 p.
14. Kemenkes RI. Farmakope Herbal Indonesia Edisi Kedua. 2nd ed. Jakarta: Departemen Kesehatan Republik Indonesia; 2017. 209–213 p.
15. Nur RM, Dewi R, Kaliu S. Antibacterial activity of methanol extract Rhizophora mucronata leaves toward Salmonella typhi: leading the typhoid fever. Pharmaciana. 2022 Nov 14;12(3):364. https://doi.org/10.12928/pharmaciana.v12i3.22475
16. Karthika, S J, S P. TLC and HPTLC Fingerprint Profiles of Different Bioactive Components from the Tuber of Solena amplexicaulis. Journal of Pharmacognosy and Phytochemistry JPP. 2014;3(31):198–206.
17. Hanifah HN, Hadisoebroto G, Dewi L. Comparison of phenolic, flavonoid, and tannin contents from ethanol extract of Kratom stem (Mitragyna speciosa Korth.) and senggani flower (Melastoma malabathrium L.). J Phys Conf Ser. 2021 Apr 1;1869(1):012002. https://doi.org/10.1088/1742-6596/1869/1/012002
18. Chang CC, Yang MH, Wen HM, Chern JC. Estimation of total flavonoid content in propolis by two complementary colometric methods. J Food Drug Anal. 2020 Jul 14;10(3). https://doi.org/10.38212/2224-6614.2748
19. Saptarini NM, R. Mustarichie, Aulifa DL, R. Hendriani, Herawati IE. Analysis of Antioxidant and Antibacterial Activity of Leaves Of Fig (Ficus carica L.) From Ciwidey Distric, West Java, Indonesia. RASAYAN Journal of Chemistry. 2022;(Special Issue):172–9. https://doi.org/10.31788/RJC.2022.1558205
20. Abubakar AR, Haque M. Preparation of Medicinal Plants: Basic Extraction and Fractionation Procedures for Experimental Purposes. J Pharm Bioallied Sci. 2020 Jan;12(1):1–10. https://doi.org/10.4103/jpbs.JPBS_175_19
21. Bani AA, Amin A, Mun'im A, Radji M. Rasio Nilai Rendamen dan Lama Ekstraksi Maserat Etanol Daging Buah Burahol (Stelecocharpus burahol) Berdasarkan Cara Preparasi Simplisia. Makassar Natural Product Journal. 2023;1(3):176–84.
22. Muhtadi M, Ningrum U. Standardization of durian fruit peels (Durio zibethinus Murr.) extract and antioxidant activity using DPPH method. Pharmaciana. 2019 Nov 30;9(2):271. https://doi.org/10.12928/pharmaciana.v9i2.12652

23. Fatmawati A, Sucianingsih D, Kurniawati R, Abdurrahman M. Microscopic Identification and Determination of Total Flavonoid Content of Moringa Leaves Extract and Ethyl Acetate Fraction (Moringa oleifera L.) . Indonesian Journal of Pharmaceutical Science and Technology. 2021;1(1):66–74.
24. Herawati IE, Saepudin S. Analysis of antioxidant and standardization of ethanol extract of rumput mutiara (Oldelandia corymbosa L.). Pharmaciana. 2025 Jul 31;15(2):332–41. https://doi.org/10.12928/pharmaciana.v15i2.27939
25. Molole GJ, Gure A, Abdissa N. Determination of total phenolic content and antioxidant activity of Commiphora mollis (Oliv.) Engl. resin. BMC Chem. 2022 Dec 25;16(1):48. https://doi.org/10.1186/s13065-022-00841-x