

Antimicrobial Candidate From Ethanol Extract And Ethyl Acetate Fraction Of Betadin (*Jatropha multifida* L.) Leaves Which Actively Inhibits Clinical Isolates Of Human Skin Pathogenic Bacteria And Fungi

Goldha Faroliu^{1,*}, Nova Adriani¹, Sarah Wulandari¹

¹Faculty of Pharmacy and Health Science, Abdurrah University, Pekanbaru, Indonesia

Email: goldhaf@univrab.ac.id

(Submit 24/06/2025, Revisi 01/12/2025, Diterima 06/12/2025 , Terbit 27/12/2025)

ABSTRACT

Betadin leaf (Jatropha multifida L.) is an ornamental plant in Indonesia and is rarely used, but its leaf sap has been reported to accelerate wound healing due to skin infections. This has the potential to be used for the development of new antimicrobial agents. The extraction method was carried out by maceration using 96% ethanol and fractionation with ethyl acetate. Extracts and fractions analyzed for the presence of various phytochemical constituents. Antibacterial assay used disc diffusion (Kirby-Bauer's) method towards Propionibacterium acnes, Staphylococcus epidermidis, Corynebacterium diphtheriae, Microsporum canis and Epidermophyton floccosum. Ethanol extract of Betadin leaves contained Alkaloids, Flavonoids, Phenolics, Steroids, Terpenes, Saponins, while the ethyl acetate fraction contained Alkaloids, Phenolics, Terpenes. J. multifida leaf ethanol extract has strong activity towards Microsporum canis and Epidermophyton floccosum, and has weak activity towards Propionibacterium acnes, Staphylococcus epidermidis, and Corynebacterium diphtheriae. While J. multifida leaf ethyl acetate fraction has strong activity towards Propionibacterium acnes, Microsporum canis and Epidermophyton floccosum, and has weak activity towards Staphylococcus epidermidis, and Corynebacterium diphtheriae. Based on the results of this study can be concluded that both the ethanol extract and the ethyl acetate fraction of Betadin leaves (Jatropha multifida L.) had the ability to inhibit the growth of bacteria and fungi, then can be antimicrobial candidate of herbal medicine.

Keywords: *Jatropha multifida L., Propionibacterium acnes, Staphylococcus epidermidis, Corynebacterium diphtheriae, Microsporum canis and Epidermophyton floccosum*

Corresponding Author: Goldha Faroliu

Address: Faculty of Pharmacy and Health Science, Abdurrah University, Pekanbaru, Indonesia

Email: goldhaf@univrab.ac.id



INTRODUCTION

Betadin plant (*Jatropha multifida* L.) is a plant that is rarely used by people in Indonesia, especially in Sumatra, but its leaf sap has been reported to accelerate wound healing due to skin infections. Many of them use Betadin plants as ornamental plants (Liana & Utama, 2018). *J. multifida* is commonly called coral bush, characterized as a shrub up to 1.30 m high and can reach 7 m in its habitat. It has green leaves up to 17 cm long and 23 cm wide, with red flowers up to 20 cm long, fruit up to 3 cm long and 2.5 cm in diameter (de Carvalho et al., 2018).

The Betadin plant (*Jatropha multifida* L.) is known to contain alkaloid and flavonoid compounds. Flavonoids are secondary metabolites and polar compounds, so they can dissolve in alcohol (Liana & Utama, 2018). Alkaloids have the ability to inhibit antibacterial and inhibitory mechanisms by disrupting the peptidoglycan composition in bacterial cells (Compean & Ynalvez, 2014). *J. multifida* sap is known to contain cyclic peptides, phenolics, and glucosides. Meanwhile, the stem

of *J. multifida* contains several compounds such as multifidone, japodagrone, multidione, multifolone, jatrogrossidentadione and macrocyclic diterpenoids. *J. multifida* latex is known to produce wound healing activity and hemostatic effects. Betadin plants also contain jatrophine alkaloid compounds, lectins and saponins which have been associated with wound healing activity due to skin infections (Rusdy et al., 2021)(M. Shakeera Banu & Sujatha, 2012).

The Betadin plant (*J. multifida* L) has chemical contents, namely campesterol, alpha amirin, stigmaterol, 7 alpha dio, HCN and beta-sitosterol, the contents of the stem of the Betadin plant (*J. multifida* L) are alkaloids, flavonoids, saponins and tannins. The content in iodine tree sap is thought to be anti-inflammatory is flavonoids. Meanwhile, lectins has activity to stimulate skin cell growth. The antibiotics contained in saponins can speed up wound healing because they inhibit bacterial growth. (Cristina Dewi, 2015). Until now, only the sap and stems of the plant have had their chemical content reported, and not much has been

reported on the chemical content of the Betadin leaves.

The highest prevalence of disease in Indonesia is degenerative diseases, followed by infectious diseases from microorganisms such as bacteria, viruses and fungi. Bacterial skin infections include irritation, acne, boils, impetigo, folliculitis, cellulitis, and leprosy. These infections can cause various symptoms such as lumps, redness, pain, swelling, and crusting on the skin.

One of the most common skin infections affecting the community is acne, the prevalence of acne is 80-100% in adolescents, namely 14-17 years in girls and 16-19 years in boys (Hasanah & Novian, 2020)(Sandhya S et al., 2011)(Suman Shrivastava et al., 2017). From a survey in the Southeast Asia region, there were 40-80% of cases of Acne vulgaris, whereas in 2006 in Indonesia, according to cosmetic dermatology study records, there were 60% of cases of Acne vulgaris, in 2007 it was 80% and in 2009 there were 90% of Acne vulgaris sufferers (Sibero et al., 2019)(Sonali Syal et al., 2020)(Kadam Trupti V et al., 2015).

Bacteria that can trigger inflammation in acne are *Propionibacterium acnes* and *Staphylococcus epidermidis* (Wahyu et al., 2017)(Mariam K. Abdrabaa & Flayyih, 2018)(Anggraeni et al., 2024).

Propionibacterium acnes works by breaking down free fatty acids from skin lipids due to the lipase enzyme produce by bacteria, so that the broken down fatty acids can cause inflammation and cause acne (*Acne vulgaris*) (Wulandari et al., 2020)(Ihsanul Hafiz et al., 2022). *Acne vulgaris* is a skin disorder that is often found on facial skin but can also occur on the upper arms, chest and back and can appear with inflammatory and non-inflammatory lesions (Yan et al., 2018)(Sani Ega Priani et al., 2022). Meanwhile, *Staphylococcus epidermidis* is one of the bacteria that can cause opportunistic infections. Naturally, these bacteria live on the skin and mucous membrane of humans. *Staphylococcus epidermidis* is the cause of skin infections characterized by swollen abscesses (Madani, 2017). These two bacteria do not cause disease under normal circumstances,

but if skin conditions change, these bacteria can become invasive (Wahyu et al., 2017).

Apart from *Propionibacterium acnes* and *Staphylococcus epidermidis*, there are other bacteria that cause infection, namely *Corynebacterium*. *Corynebacterium* generally only causes infections of the upper respiratory tract (Tjengal et al., 2019). However, its bacteria is a pathogenic bacteria that can cause diphtheria. This disease can cause death, especially in children who do not have a history of vaccination. Symptoms include a sore throat, membrane lesions appearing followed by enlarged and softened lymph glands. Apart from that, this bacteria can sometimes cause infections of the stomach, lungs and skin membranes (Sariadji et al., 2015).

Microsporum canis is a type of fungus that can attack human scalp keratinized tissue and cause an infection known as dermatophytosis. According to Amir et al (2006), *Microsporum canis* is considered a type of fungus that causes dandruff infection in humans in various

countries including Indonesia (Indonesia, 2018).

Epidermophyton floccosum is an anthropophilic dermatophyte that causes tinea pedis and tinea corporis. Dermatophytosis is a disease caused by the colonization of dermatophyte fungi which attack tissues containing keratin (horny substance) such as the stratum corneum in the epidermis of the skin, hair and nails. Dermatophyte fungi are in the Arthrodermataceae family with more than 40 species divided into three genera: *Epidermophyton*, *Microsporum*, and *Trichophyton* (Ena & Karna, 2021).

According to Yunita Liana (2018), previous research revealed that based on phytochemical results, Betadin leaves contained phenol, tannin and flavonoid compounds, the results of research on activity tests against *Staphylococcus aureus* bacteria. Apart from that, flavonoids are antimicrobials which is able to form complex compounds with soluble extracellular proteins and microbial cell walls. Flavonoids are anti-inflammatory so they can reduce inflammation and help reduce pain if bleeding or swelling occurs in the

wound. Phenolic compounds have the ability to form complex compounds with proteins through hydrogen bonds, so they can damage bacterial cell membranes (Liana & Utama, 2018).

Research on Betadin leaves (*Jatropha multifida* L.) has been studied by Dwi Anggita (2018) using leaf extract and sap of the *Jatropha* plant (*Jatropha multifida* L.) as an antibacterial against *Staphylococcus aureus* bacteria in vitro, the best concentration was found at an extract concentration of 100 % with an average diameter of 21.91 mm and almost approaching the inhibition zone of the comparison antibiotic, namely Clindamycin as a positive control, and it can be concluded that the leaves and sap of the Betadin plant (*Jatropha multifida* L.) have antibacterial activity against *Staphylococcus aureus* bacteria. Yunita Liana (2018), the results of research Betadin leaves activity tests against *Staphylococcus aureus* bacteria. The research will further examine the activity of compounds in extracts and fractions of Betadin leaves against *Propionibacterium acnes*, *Staphylococcus epidermidis*,

Corynebacterium diphtheriae, *Microsporum canis*, and *Epidermophyton floccosum*.

MATERIALS AND METHODS

Materials

Betadin (*Jatropha multifida* L.) leaf samples were harvested in Bantan, Bengkalis, Riau and identified at the Botany Laboratory of Riau University with the number specimen 08/UN/19.5.1.1.3-4.1; rotary evaporator, vials, erlenmeyer, separating funnel, Laminar Air Flow (LAF), incubator (Mettler®), autoclave (model 25X -2), petri dish, hotplate (Cimarec®), blank disc, ethanol 96%, ethyl acetate, distilled water, ammonia chloroform, , Mg-HCl's Reagent, Glacial CH₃COOH, FeCl₃ 10%, Mayer's reagent, Dragendorff's reagent, Liebermann-Bouchard's reagent, Mueller Hinton Agar (MHA), H₂SO₄ 1%, BaCl₂ 1% Dimethyl sulfoxide (DMSO) (Merck®), disc paper, chloramphenicol, 70% alcohol, physiological NaCl solution. Clinical isolate test microbe: *Propionibacterium acnes* ATCC 6919, *Staphylococcus epidermidis* ATCC 12228, *Corynebacterium*

diphtheria ATCC 13812,
Microsporum canis and
Epidermophyton floccosum.

Collection of Plant Material

Betadin (*Jatropha multifida* L.) leaf samples were harvested in Bantan, Bengkalis, Riau and identified at the Botany Laboratory of Riau University with the number specimen 08/UN/19.5.1.1.3-4.1.

Extraction Procedure

8000 grams of Betadin (*Jatropha multifida* L.) leaf samples were wet sorted, cleaned then air dried, then dry sorted and blended until smooth. 900 grams of Betadin leaf simplicia (*Jatropha multifida* L.), extracted using the maceration method using 96% ethanol with 1:4 ratio of solvent, and repeated for 3x24 hours, stirred and left in a closed vessel, then filtered and the filtrate taken. Next, the filtrate was concentrated using a rotary evaporator until a thick extract was obtained (Harliananda et al., 2019).

Fractionation

Fractionation was carried out as follows: 30 grams of 96% ethanol extract of Betadin leaves (*Jatropha multifida* L.), dissolved in 90 mL of

distilled water, put into a separating funnel, added 90 mL of ethyl acetate solvent, shaken slowly, then allowed to stand until separation occurred between ethyl acetate and ethanol fractions. The ethyl acetate fraction was separated, then the filtering was repeated several times until the solution was clear. Next, the filtrate was concentrated using a rotary evaporator to obtain a thick fraction (Tumiar Pakpahan, 2020).

Phytochemical Screening

The extracts and fractions were analyzed for the presence of various phytochemical constituents like Phenolic (FeCl_3), Flavonoids (Mg-HCl), Terpenes / steroids (Liebermann -Burchard's Test), Alkaloids (Mayer and Dragendorff), and Saponins with phytochemical procedures.

Antibacterial Activity

Antibacterial screening of the extracts and fractions was carried out by disk diffusion, following the modified method of Kirby-Bauer, and compared to that of chloramphenicol (30 $\mu\text{g}/\text{disc}$) in dimethyl sulfoxide (DMSO) as positive control and DMSO as blank

control. The tested bacteria were *Propionibacterium acnes* ATCC 6919, *Staphylococcus epidermidis* ATCC 12228, and *Corynebacterium diphtheria* ATCC 13812. The bacterial suspensions were prepared by dilution in NaCl 0.9%. The suspension was swabbed onto an agar petri dish (MHA Medium). 10 μ L of positive control and negative control (DMSO) were dropped onto a paper disk (Whatman No.1, diameter 5 mm) and carefully placed onto a surface cultivation dish. The experiment was done in triplicate for each bacterium. Each dish was then incubated at 37°C for 16 to 18 hours. The inhibition zones (including the disk diameter) were measured (Faroliu, Anggraini, et al., 2023; Sartika et al., 2019).

Antifungi Activity

Testing the antifungal activity of Betadin leaf extract used the disc diffusion method. PDA (Potato Dextrose Agar) media. Antifungal screening of the extracts and fractions was carried out by disk diffusion, following the modified method of Kirby-Bauer, and compared to that of ketoconazole (20 μ g/disc) in dimethyl sulfoxide (DMSO) as

positive control and DMSO as blank control. The tested fungi were *Microsporum canis* and *Epidermophyton floccosum*. The fungal suspensions were prepared by dilution in NaCl 0.9%. The suspension was swabbed onto an agar petri dish (PDA Medium). 10 μ L of positive control and negative control (DMSO) were dropped onto a paper disk (Whatman No.1, diameter 5 mm) and carefully placed onto a surface cultivation dish. The experiment was done in triplicate for each fungal. Each dish was then incubated at 25°C for 72 to 96 hours. The inhibition zone formed is measured using a caliper and the strength of the inhibition zone is interpreted (Faroliu, Sidoretno, et al., 2023).

RESULTS AND DISCUSSION

From an 8000 grams sample of Betadin leaves (*Jatropha multifida* L.) was obtained 900 grams of simplisia, and a thick ethanol extract of 66.87 grams (7.43%) was obtained, then the extract was fractionated with ethyl acetate solvent to obtain a fractionated extract of 9.192 grams (0.46%).



Figure 1. *J. multifida* L. (Personal documentation)

Phytochemical Screening

The results of the phytochemical analysis investigated for *Jatropha multifida* extracts and fractions are presented in Table 1.

Table I. Phytochemical test results of extract and fractions of Betadin leaves (*Jatropha multifida* L.)

Secondary metabolite	Extract	Result	Fraction	Result
Alkaloids	+	White precipitate	+	White precipitate
Flavonoids	+	Yellow	-	Green
Phenolic	+	Blackish green	+	Blackish green
Saponins	+	Foamy $\pm$ 3 minutes	-	No foamy
Terpens	+	Blackish green	+	Blackish green
Steroids	+	Green	-	Black

After carrying out phytochemical screening, the results were found, namely that the ethanol extract of Betadin leaves was positive for containing alkaloids, flavonoids, phenolics, saponins, steroids and terpenes. And in the phytochemical

screening of the ethyl acetate fractionation of Betadin leaves, the results were obtained alkaloid, phenolic and terpenes compounds, while other compounds such as flavonoids, saponins and steroids were were not detected.

Antimicrobial Assay Activity

The results of the antimicrobial activity for *Jatropha multifida* extract and fractions are presented in Table 2.

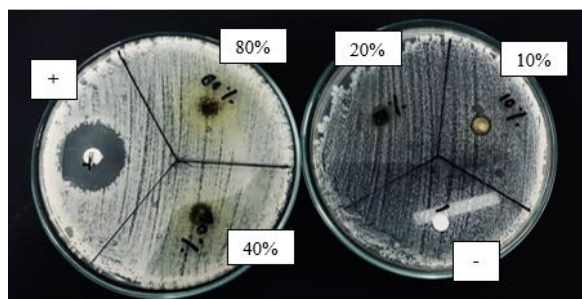


Figure 2. Results of the antimicrobial activity of Betadin leaves extracts against *S. epidermidis*

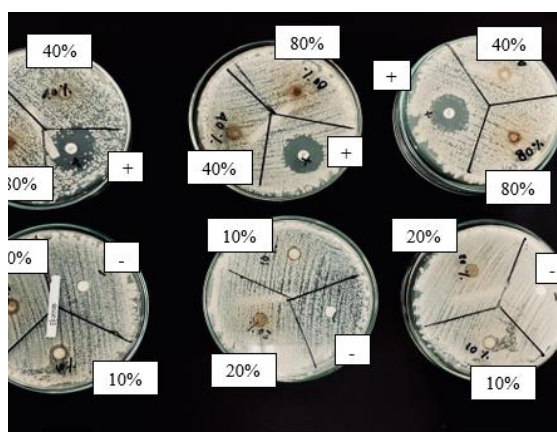


Figure 3. Results of the antimicrobial activity of Betadin leaves extracts against *P. acnes*

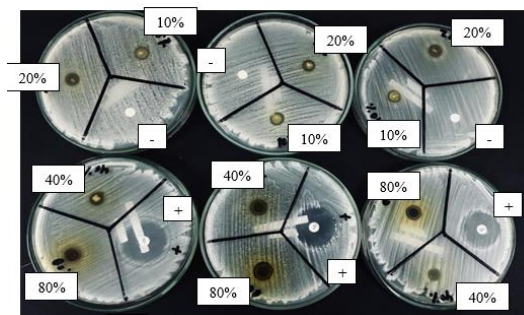


Figure 4. Results of the antimicrobial activity of Betadin leaves extracts against *C. diptheriae*

Based on this research, the ethanol extract of Betadin leaves (*Jatropha multifida* L.) showed inhibitory activity against *Staphylococcus epidermidis* with an inhibition zone diameter of 7.56 mm (10 µg/disc), *Propionibacterium acnes* with an inhibition zone diameter of 7.90 mm (10 µg/disc), and *Corynebacterium diphtheria* with an inhibition zone diameter of 8.63 mm (10µg/disc), with a weak inhibitory category for these three bacteria. Meanwhile, testing of the ethyl acetate fraction of Betadin leaves showed that it had an inhibitory effect on the bacteria *Staphylococcus epidermidis* with an inhibition zone diameter of 7.4 mm (10 µg/disc), *Propionibacterium acnes* with an inhibition zone diameter of 8.33 mm (10 µg/disc), and *Corynebacterium diphtheria* with an inhibition zone diameter of 11.9 mm (10µg/disc), with a weak

inhibitory activity category for *Staphylococcus epidermidis* and *Corynebacterium diphtheria* bacteria, and a strong inhibitory activity for *Propionibacterium acnes* bacteria.

Based on research results from Anggita (2018), Betadin leaf extract and its sap had the ability to inhibit the growth of *Staphylococcus aureus* bacteria, with the best concentration being 100% concentration which forms an inhibitory zone of 22.24 mm and Betadin sap with the best concentration being 100% concentration which forming an inhibition zone of 21.91 mm (Dwi Anggita et al., 2018). And based on this research results from Betadin leaf extract had bacteriostatic potential against *S. aureus* and *P. aeruginosa* because there was still bacterial growth in the inhibitory zones(Ivan et al., 2019).

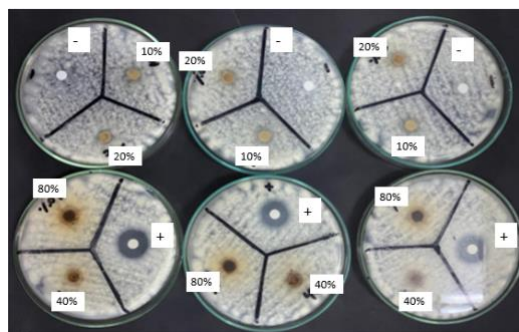


Figure 5. Results of the antimicrobial activity of Betadin leaves extracts against *Microsporium canis*

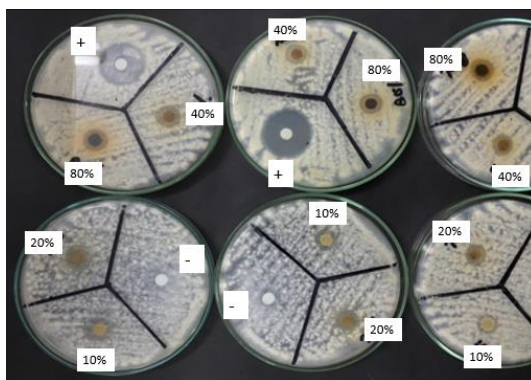


Figure 6. Results of the antimicrobial activity of Betadin leaves extracts against *E. floccosum*

In antifungal activity testing, the ethanol extract of Betadin leaves (*Jatropha multifida* L.) showed inhibitory power against the fungi *Microsporum canis* and *Epidermophyton floccosum*. Against the fungus, *Microsporum canis* showed inhibitory activity with an inhibition zone of 15.3 mm (10µg/disc), and *Epidermophyton floccosum* showed inhibitory activity with an inhibition zone of 17.16 mm (10µg/disc), with a strong inhibitory activity category for the antifungal test. Meanwhile, testing of the ethyl acetate fraction of Betadin leaves (*Jatropha multifida* L.) showed that it had an inhibitory activity on *Microsporum canis* and *Epidermophyton floccosum*. Against the *Microsporum canis* showed inhibitory activity with an inhibition

zone of 10.37 mm (10µg/disc), and *Epidermophyton floccosum* showed inhibitory power with an inhibition zone of 15.26 mm (10µg/disc), with a strong inhibitory power category for the antifungal test.

Table II. Antimicrobial test results of Betadin Leaf Extracts and Fractions (*Jatropha multifida* L).

Mic robe	Extract		Fraction		(+) Bact	(+) Fungi
	10µg/disc	20µg/disc	10µg/disc	20µg/disc	30µg/disc	20µg/disc
SE	7.56 ± 0.4	8.23 ± 0.2	7.4 ± 0.1	8.3 ± 0.1	22.2 ± 0.2	
PA	7.9 ± 0.6	8.33 ± 0.9	11.16 ± 2.2	13.4 ± 0.5	23.3 ± 0.4	
CD	8.63 ± 1.2	11.9 ± 0.8	7.6 ± 0.5	12.23 ± 0.2	22.9 ± 0.8	
MC	15.3 ± 0.2	18.23 ± 1.7	10.37 ± 0.1	10.56 ± 0.1		25.2 ± 2.1
EF	17.16 ± 0.7	17.83 ± 0.2	15.26 ± 0.2	16.66 ± 0.5		24.4 ± 0.8

Notes:

SE : *S. epidermidis*

PA : *P. acnes*

CD: *Corynebacterium diptheriae*

MC: *Microsporum canis*

EF: *E. floccosum*

(+) Bact : Control Positive Bacteria (Chloramphenicol)

(+) Fungi : Control Positive Fungi (Ketoconazole)

J. multifida leaf ethanol extract has strong activity towards *Microsporum canis* and *Epidermophyton floccosum*, and has weak activity towards *Propionibacterium acnes*, *Staphylococcus epidermidis*, and

Corynebacterium diphtheriae. While *J. multifida* leaf ethyl acetate fraction has strong activity towards *Propionibacterium acnes*, *Microsporum canis* and *Epidermophyton floccosum*, and has weak activity towards *Staphylococcus epidermidis*, and *Corynebacterium diphtheriae*.

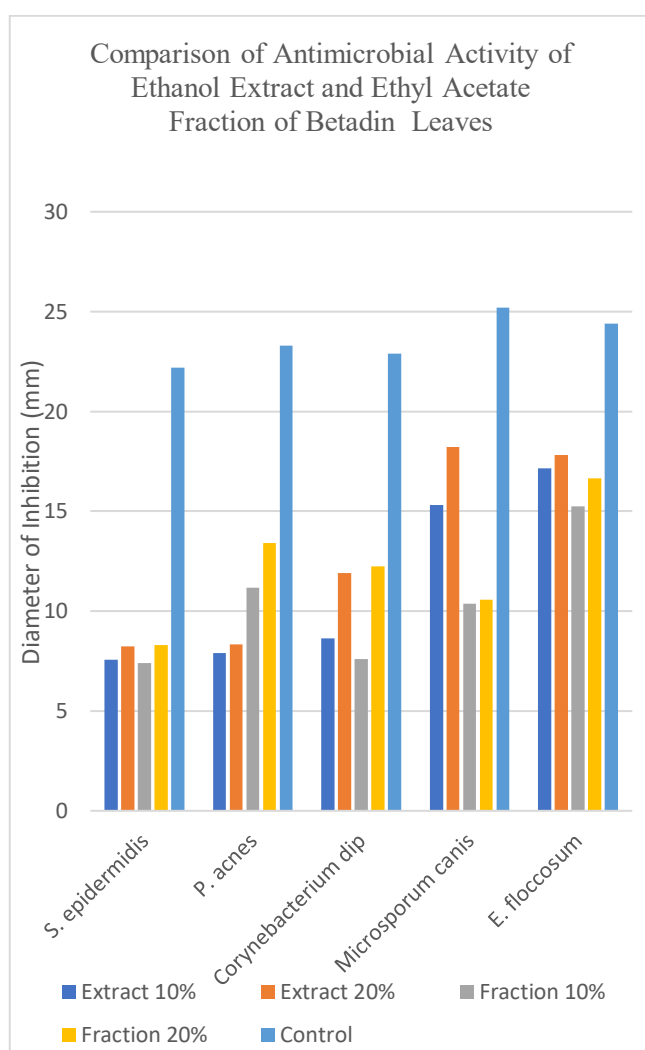
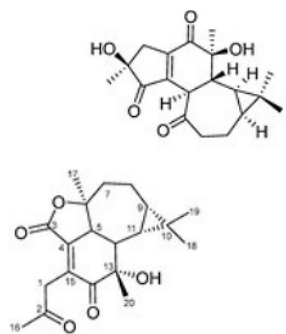


Figure 7. Comparison of Antimicrobial Activity of Ethanol Extract and Ethyl Acetate Fraction of Betadin Leaves

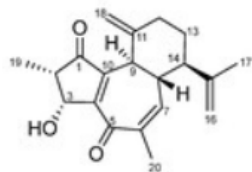
From the phytochemical screening that has been carried out, it was found that the content of bioactive compounds including phenolics, flavonoids, and saponins that has the potential as a compound that can inhibit the growth of bacteria and fungi. The results of phytochemical screening in this study were in line with research conducted by Sansetyawati et al. which is stated that the compounds contained in the tintir castor plant had good benefits to be used as antibacterials (Sansetyawati, 2015).

J. multifida contains several Terpens compounds such as multifidone, jatrophalone, jatrophalactone, japodagrone, multidione, multifolone, jatrogrossidentadione and macrocyclic diterpenoids. Also contains jatrophine alkaloid, lectins, phenolics and saponins.

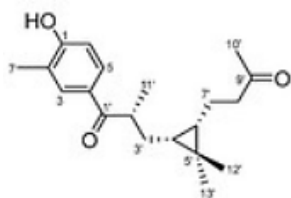
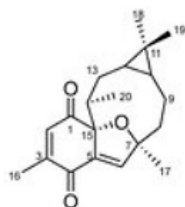


Jatrophalone

Jatrophalactone



Jatrogrossidentadione



Multifidone

Multidione

Alkaloids can have the potential to act as antibacterials by interfering with the peptidoglycan components in bacterial cells, causing bacterial cells to lyse. Flavonoids and other phenolic compounds disrupt bacterial cell membranes (Ayunanda et al., 2025). Phenolics can have the potential to act as antibacterials by denaturing proteins as a result of which the bacterial cell walls are damaged and the hydroxyl groups enter the bacterial cell nucleus, causing the bacteria to die. Terpenoids have the potential to act as antibacterials by

causing lysis of bacterial cells by binding to proteins, lipids and carbohydrates found in microbes. Meanwhile, saponin has the potential to act as an antibacterial by inhibiting or killing bacteria by reducing cell surface tension and causing cell lysis.

Alkaloids are inserted between DNA and cell walls and inhibit fungal DNA replication resulting in disrupted fungal growth. Flavonoids act as antifungals by inhibiting the transfer of mitochondrial electrons so that the mitochondrial membrane potential is reduced. This inhibition can occur through inhibition of protons in the respiratory chain resulting in a decrease in ATP production and subsequent fungal cell death. Damage to organic components and altered nutrient transport cause fungal cells to die or lyse because there are hydroxyl groups (-OH) in flavonoid compounds. Terpenoids can inhibit fungal growth through the cytoplasmic membrane or prevent fungal spores from growing. Meanwhile, saponin acts as an antifungal by disrupting the stability of microbial cell membranes, causing microbial cells to lyse or die.

CONCLUSION

Based on the results of this research can be concluded the ethanol extract and ethyl acetate fraction of *J. multifida* leaves demonstrated in vitro antibacterial and antifungal activities against the tested skin-related pathogens, indicating their potential as preliminary antimicrobial candidates for further investigation as herbal medicines.

ACKNOWLEDGMENT

Thanks to the parties from Natural Product Laboratory and Microbial and Parasitology Laboratory on Faculty of Pharmacy and Health Sciences Abdurrah University who helped in this research.

CONFLICT OF INTEREST

There is no conflicts of interest in this research.

REFERENCES

Anggraeni, Y., Firdausi, N., Randy, A., Dewi, R. T., Kusumastuti, S. A., Sani, Y., Yuliani, T., Septiyanti, M., & Angelina, M. (2024). Formulation and Antibacterial Activity Test of Cream containing *Cassia alata*

Leaves Extract against *Propionibacterium acnes* and *Staphylococcus epidermidis*. *Research Journal of Pharmacy and Technology*, 17(3), 1356–3.

Ayunanda, N. P. R., Fitriani, H., Zubair, M. S., & Syukri, Y. (2025). Genus Begoniaceae: A review of phytochemical and pharmacological activity. *Jurnal Farmasi Galenika: Galenika Journal of Pharmacy*, 11(2), 78–92.

Compean, K. L., & Ynalvez, R. A. (2014). 2014 _ Antimicrobial activity of plant secondary metabolites.pdf. In *Research Journal of Medicinal Plant* (Vol. 8, Issue 5, pp. 204–213).

Cristina Dewi, S. (2015). Perbedaan efek perawatan luka menggunakan getah pohon yodium (*Jatropha multifida*) dan povidon iodine 10% dalam mempercepat penyembuhan luka bersih pada marmut (*Cavia porcellus*). *Jurnal Wiyata*, 2(1), 79–86.

de Carvalho, C., Vieira Mariano, L., S Negrão, V., Passarelli Gonçalves, C., & Cristina Ribeiro Marcucci, M. (2018).

- Phenols, flavonoids and antioxidant activity of *Jatropha multifida* L. collected in Pindamonhangaba, Sao Paulo State, Brazil. *Journal of Analytical & Pharmaceutical Research*, 7(5). <https://doi.org/10.15406/japlr.2018.07.00286>
- Dwi Anggita, Abdi, D. A., & Desiani, V. (2018). Efektifitas Ekstrak Daun Dan Getah Tanaman Jarak Cina (*Jatropha multifida* L.) Sebagai Antibakteri Terhadap Pertumbuhan Bakteri *Staphylococcus Aureus* Secara In Vitro. *Window of Health*, 1(1), 29–33.
- Ena, K., & Karna, R. V. (2021). Profil Dermatofitosis di Poliklinik Kulit dan Kelamin di RSUP Sanglah Denpasar Periode 2017-2018. *Medika Udayana*, 10(4), 99–104.
- Faroliu, G., Anggraini, A. F., & Wisni, A. P. (2023). Potensi Antimikroba Fraksi Etil Asetat Daun Mangkokan (*Nothopanax scutellarius* (Brum. f.) Fosberg) Terhadap Berbagai Mikroba Patogen. *Journal of Pharmacy and Science*, 7(1), 167–175.
- Faroliu, G., Sidoretno, W., & Putri, A. (2023). Perbandingan Aktivitas Antijamur Ekstrak dan Fraksi Daun Gelinggang (*Cassia alata* L.) Terhadap *Malassezia globosa* dan *Microsporum canis*. *Journal of Pharmacy and Science*, 7(1), 63–69.
- Harliananda, N., Halimatussakdiah, & Amna, U. (2019). Analisis Kualitatif Senyawa Metabolit Sekunder Daun Betadin (*Jatropha multifida* L.). *Quimica: Jurnal Kimia Sains Dan Terapan*, 1 (1)(April), 7.
- Hasanah, N., & Novian, D. R. (2020). Daya Hambat Ekstrak Daun Belimbing Wuluh (*Averrhoa bilimbi* L) Terhadap Bakteri Penyebab Jerawat (*Propionibacterium acnes*). *Dede Rival Novian*, 9(1), 46–53.
- Ihsanul Hafiz, Novilia, L., Luthvia, Husna, N., & Lubis, M. F. (2022). Antibacterial Activity of Water, Ethyl Acetate and n-Hexane Fractions of Pagoda leaves (*Clerodendrum paniculatum* L.) against *Propionibacterium acnes*. *Research Journal of Pharmacy and Technology*, 15(6), 2521–

- 2524.
- Indonesia, J. M. (2018). *Jurnal Mikologi Indonesia*. 2(2), 67–76.
- Ivan, Sudigdoadi, S., & Kartamihardja, A. H. S. (2019). Antibacterial Effect of *Jatropha multifida* L. Leaf Infusion towards *Staphylococcus* and *Pseudomonas aeruginosa*. *Althea Medical Journal*, 6(2).
- Kadam Trupti V, S, W. S., A.B, D., & R.B, S. (2015). An Overview: Acne Vulgaris. *Res. J. Pharm. Dosage Form. & Tech*, 7(2), 156–160.
- Liana, Y., & Utama, Y. A. (2018). Efektifitas pemberian ekstrak daun betadine (*Jatropha muitifida* linn) terhadap ketebalan jaringan granulasi dan jarak tepi luka pada penyembuhan luka sayat tikus putih (*rattus norvegicus*). *Jurnal Kedokteran Dan Kesehatan*, 5(3), 114–123.
- M. Shakeera Banu, & Sujatha, K. (2012). Antimicrobial potential of ethanolic extract of *Psidium guajava* leaf and its isolated fraction against some pathogenic microorganisms. *Research J. Pharmacology and Pharmacodynamics*, 4(3), 169–171.
- Madani, A. (2017). Perbandingan Aktivitas dan Mekanisme Penghambatan Antibakteri Ekstrak Air dengan Ekstrak Etil asetat Gambir (*Uncaria gambir* Roxb) Terhadap Bakteri *Staphylococcus epidermidis*, *Streptococcus mutans*, dan *Streptococcus pyogenes*. *Angewandte Chemie International Edition*, 6(11), 951–952., 1–77.
- Mariam K. Abdrabaa, & Flayyih, M. T. (2018). Autolysis activity of Vancomycin Resistance *Staphylococcus epidermidis*. *Asian J. Pharm. Res*, 8(4), 225–230.
- Rusdy, H., Pasaribu Saruksuk, A. S., Dalimunte, R. S., & Dohude, G. A. (2021). Efektivitas getah batang betadine (*Jatropha multifida* L.) terhadap penyembuhan luka pasca pencabutan gigi pada tikus Sprague-Dawley. Effectiveness of betadine (*Jatropha multifida* L.) stem sap on the wound healing after tooth extraction in Sprague-. *Jurnal Kedokteran*

- Gigi Universitas Padjadjaran, 33(2), 145.
<https://doi.org/10.24198/jkg.v33i2.32563>
- Sandhya S, E, V. S., Banji, D., & T, R. (2011). A Review on Medicinal Herbs Used for Acne. *Res. J. Topical and Cosmetic Sci*, 2(2), 40–44.
- Sani Ega Priani, Nurhasanah, E., & Suparman, A. (2022). Development of Antiacne Nanogel containing Cinnamon Bark Oil (*Cinnamomum burmannii* Nees ex Bl.) and Olive Oil (*Olea europaea* L.). *Research Journal of Pharmacy and Technology*, 15(1), 143–147.
- Sansetyawati, M. (2015). *Antibacterial Activity Test of Iodine Plant Ethanol Extract (Jatropha multifida L.) Against Staphylococcus aureus ATCC 6538 and Escherichia coli ATCC 11229 by In Vitro*. Muhammadiyah University of Surakarta.
- Sariadji, K., Sunarno, S., Khariri, K., Puspandari, N., Muna, F., & Rukminiati, Y. (2015). Selektivitas Medium Cystine Tellurite Blood Agar (CTBA) terhadap Beberapa Isolat Bakteri. *Jurnal Kefarmasian Indonesia*, 5(1), 19–24.
<https://doi.org/10.22435/jki.v5i1.4082>.19-24
- Sartika, D., Sutikno, Yuliana, N., & Maghfiroh, S. R. (2019). Identifikasi Senyawa Antimikroba Alami Pangan Pada Ekstrak Kulit Buah Naga Merah Dengan Menggunakan GC-MS. *Jurnal Teknologi & Industri Hasil Pertanian*, 24(2), 67–76.
- Sibero, H. T., Sirajudin, A., & Anggraini, D. (2019). Prevalensi dan Gambaran Epidemiologi Akne Vulgaris di Provinsi Lampung The Prevalence and Epidemiology of Acne Vulgaris in Lampung. *Jurnal Farmasi Komunitas*, 3(2), 62–68.
- Sonali Syal, Pandit, V., & Ashawat, M. S. (2020). Traditional Herbs to treat Acne Vulgaris. *Asian J. Pharm. Res*, 10(3), 195–201.
- Suman Shrivastava, Tirkey, R., Kujur, A., Jangde, R., & Daharwal, S. J. (2017). Glimpses of Ethnopharmacological Approaches to Treat Acne.

- Research J. Topical and Cosmetic Sci*, 8(1), 40–49.
- Tjengal, B., Alifia, A., & Intan, N. S. (2019). Kit Diagnostik Difteri Berbasis Hibridisasi Dna. *Berkala Ilmiah Mahasiswa Farmasi Indonesia (BIMFI)*, 6(1).
<https://doi.org/10.48177/bimfi.v6i1.16>
- Tumiar Pakpahan, D. (2020). Antibacterial Activity of N-Hexane, Ethyl Acetate, and Butanol Fraction of Lead Tree (*Leucaena leucocephala* (Lam.) de Wit) Leaves Against *Propionibacterium acnes* and *Staphylococcus epidermidis*. *Indonesia Natural Research Pharmaceutical Journal*, 5(2), 12–19.
- Wahyu, Y., Mulyani, T., Hidayat, D., & Fatimah, Y. (2017). Ekstrak Daun Katuk (*Sauropus androgynus* (L) Merr) sebagai Antibakteri Terhadap *Propionibacterium acnes* dan *Staphylococcus epidermidis* Antibacterial Activity of (*Sauropus androgynus* (L) Merr) Extract Againsts *Propionibacterium acnes* and *Staphylococcus epidermidis*. *JFL Jurnal Farmasi Lampung*, 6(2), 46–55.
- Wulandari, A., Farida, Y., & Taurhesia, S. (2020). Perbandingan Aktivitas Ekstrak Daun Kelor Dan Teh Hijau Serta Kombinasi Sebagai Antibakteri Penyebab Jerawat. *Jurnal Fitofarmaka Indonesia*, 7(2), 23–29.
<https://doi.org/10.33096/jffi.v7i2.535>
- Yan, H. M., Zhao, H. J., Guo, D. Y., Zhu, P. Q., Zhang, C. L., & Jiang, W. (2018). Gut microbiota alterations in moderate to severe acne vulgaris patients. *Journal of Dermatology*, 45(10), 1166–1171.
<https://doi.org/10.1111/1346-8138.14586>

ADDITIONAL INFORMATION

Publisher's Note

All claims expressed in this article are solely those of the authors and do not necessarily reflect the views of the publisher, the editors, or the reviewers. Any product that may be evaluated in this article, or claim made by its manufacturer, is not guaranteed or endorsed by the publisher. The publisher

remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Open Access



This article is licensed under a Creative Commons Attribution 4.0 International License. You may share and adapt the material with proper credit to the original author(s) and source, include a link to the license, and indicate if changes were made.