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Medicinal Plants Survey in Pudurnadu of Jawadhu Hills Tamil Nadu and Analysis of Phytoconstituents and Antibacterial Activity of *Bryophyllum pinnatum* Leaves Extract

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Abstract: A plant survey is usually conducted for examining a certain geographic area, analysis of existence of specific species and assessing of habitat appropriateness of those species available in that specific study area. A survey of medicinal plants in a given location helps in the comprehension of overall ecological circumstances by classifying the recorded plants into distinct biological life forms. The current study focuses on survey of ethnomedicinal plants in Pudurnadu. Pudurnadu is a village in Tirupattur district, Tamil Nadu, India, about 54 miles south of Vellore city. One of the effective ways to plant drug discovery has been discovered through ethnomedicinal survey. In our study, we recorded 146 medicinal plant species belonging to 59 families for the treatment of various ailments. The objectives of this study were to identify a rare medicinal plant in our study area and evaluate the phytochemical and antibacterial properties with several extracts of *Bryophyllum pinnatum* which was determined using the Agar well diffusion method against Gram-positive and Gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Bacillus subtilis*).

Keywords: Ethnomedicinal plant survey, Traditional medicines, *Bryophyllum pinnatum*, Phytoconstituents, Antibacterial activity

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Introduction

One of the effective ways of plant drug discovery has been discovered from ethnobotanical survey. On the basis of ethnobotanical evidences, several active ingredients have been discovered in various plants. Medicinal plants are widely employed in non-industrialized communities, owing to their accessibility and lower cost than contemporary medicines. Traditional plant medicine is not documented in most countries, although the World Health Organization maintains an organization to promote safe and sensible use. Eighty per cent of the country side people from developing nations use locally accessible medicinal plants for their primary health management (World Health Organization). Twenty thousand medicinal plants were used by local people around the world.

Naturally plants have active compounds that provides transformative advantages such as guarding against herbivores or acting as a hormone in plant defenses. If scientifically accepted, plant metabolites have the potential to be used as pharmaceuticals, these plant metabolites will be used in modern medicine.

Pudurnadu is a small village in the Jawadhu Hills, which is close to a few tourist places such as Yelagiri, the most popular waterfalls are Beemanmadavu etc. Jawadhu Hill's highest peak is 1,400 meters. The hills are meagerly populated, with the bulk of residents belonging to the Malayali tribe however, other castes are also present. The Jawadhu Hills only appeared in government gazetteers and manuals, ethnographies, and trip diaries during the British colonization of India. In 1883 correspondence, Henry le Fanu praised the Jawadhu hills for their beauty. The village covers a total area of 1933.18 hectares. The population of Pudurnadu is 6,913 people. Pudurnadu is an extremely diverse density area in terms of plant, animal, and floral diversity, yielding many important medicinal plants, which tribals in the study area have been using since ancient times but have yet to be documented in a scientific method. Detailed information of medicinal plant applications is either unavailable or poorly recorded. Since early days, local people have been using plants for exploration of new medicines to treat various illnesses (Verpoorte, 1998). The practice of exploration of a new area for research of medicinal plants is always better than the exploitation of known habitat.

Many tribal communities in India are either under explored or unexplored with regard to their plant wealth for treating diseases (Kala, 2005). Ethnobotanical studies are important for documenting indigenous knowledge and ensuring the long-term conservation and use of biological resources. The availability of facilities and information concerning upstream and down-stream bioprocessing, extraction, purification, and marketing of the industrial potential of medicinal plants is critical for the development and commercialization of medicinal plant-based bio-industries in developing countries. In addition, the lack of modernized socio-economic and public healthcare infrastructures increases rural and low-income urban residents' reliance on traditional medicinal herbs and plants as supplemental aids to standard pharmaceutical market products. Tannins, alkaloids, carbo-hydrates, terpenoids, steroids, and flavonoids are some of the chemical compounds found in medicinal plants that have a definite physiological effect on the human body (Edoga *et al*., 2005).

Because of the increasing difficulties of Multi-Drug Resistance (MDR) to human pathogenic bacteria in developing nations, there is a progressive revival of interest in the use of therapeutic plants, particularly herbal formulations, in local healthcare systems (Njoroge *et al*., 2007). *Bryophyllum pinnatum* is one of these plants that are used to treat a variety of diseases. *B. pinnatum* belongs to the family *Crassulaceae* and the common names include life plant, love plant, miracle leaf, and Canterbury bells. It is widely distributed in tropical Africa, America, Hawaii, India, China, Australia, and Madagascar (Afzal *et al*., 2013). Antimicrobials derived from

plants are a huge unexplored resource. The use of plant extracts for therapeutic purposes has grown in popularity, especially as people become more aware that antimicrobials' effective life span is limited and is becoming more prevalent and exploitation generates microbial resistance (Alam *et al*., 2009).

The plant can be used as an anti-poison and to cure conditions including high blood pressure, stroke, convulsions, pain, epilepsy, candidiasis, and bladder infections (Anonymous, 2005). Poultices made from the freshly pounded material are used to treat burns, sprains, boils, abscesses, eczema, infections and carbuncles (Okwu, 2003). The leaves of *B. pinnatum* contain substances such as glycosides, steroids, flavonoids, organic acids, alkaloids, tannins, phenolic compounds, gums, mucilages and lignin (Kamboj *et al*., 2010).

In the present work, on the basis of ethnobotanical survey, we selected high medicinal value plant and analyze the primary and secondary metabolite constituents and antibacterial activity with different solvents of *Bryophyllum pinnatum* leaf. The detailed work flow is depicted in Figure 1.

Materials and Methods

Study Area:

Pudurnadu is a village panchayat in the Jawadhu Hills, which is located in Eastern Ghats and spread across Tirupattur and Tiruvannamalai districts in Tamil Nadu, India. Pudurnadu geo coordinates are 12.4036559 latitude and 78.6886224 longitudes (Fig. 2). The hills are comprised of bluish-gray granites that appreciate in value of 3,800–4,000 feet (1,300–1,350 meters). The Agaram and Cheyyar River divides into eastern and western portions, measuring 80 km wide and 32 km long.

The study region was randomly surveyed from February 2019 to February 2021, with local people and medicinal practitioners from Jawadhu Hill villages of Pudurnadu, Pungampattunadu, Poongulam, and Kavalur Reserved Forest. Interviews and questionnaires with local people who have unique expertise about the medicinal plants were used to acquire data for this study. The discussion included information of the plants such as which plants they have used, which part of the plant are used, how medicinal drugs are given to patients, how this information obtained and transferred, their active components, therapeutic applications, preparation methods and analysis of phytoconstituents and antibacterial activity.

Collection of Plant material:

Bryophyllum pinnatum plant was collected from Pudurnadu of Jawadhu Hills. The plant materials (leaves) were identified and authenticated by Dr. N. P. M. Mohamed Tariq, Department of Botany, Islamiah College (Autonomous), Vaniyambadi, India.

Extract preparation:

The coarse powder was taken in Soxhlet apparatus and extracted with ethanol, methanol and aqueous as a solvent. A total amount of 40 g coarse powder was extracted with 400 ml of each solvent. Each slurry was then concentrated under reduced pressure to obtain crude extract. All crude extracts were kept in closed air tight containers under cool and dark place for further study (Harborne,1984; Trease *et al*., 1989).

Phytochemical analysis:

Test for proteins:

Millon's test:

The plant crude extract is mixed with 2 ml of Millon's reagent, appearance of white precipitate which turned red upon mild heating that confirmed the presence of protein.

Ninhydrin test:

The plant crude extract was boiled with 2 ml of 0.2% solution of Ninhydrin, appearance of violet colour indicated the presence of amino acids and proteins.

Test for carbohydrates:

Fehling's test:

Fehling A and Fehling B reagents were combined in an equal proportion, and 2 ml of this mixture

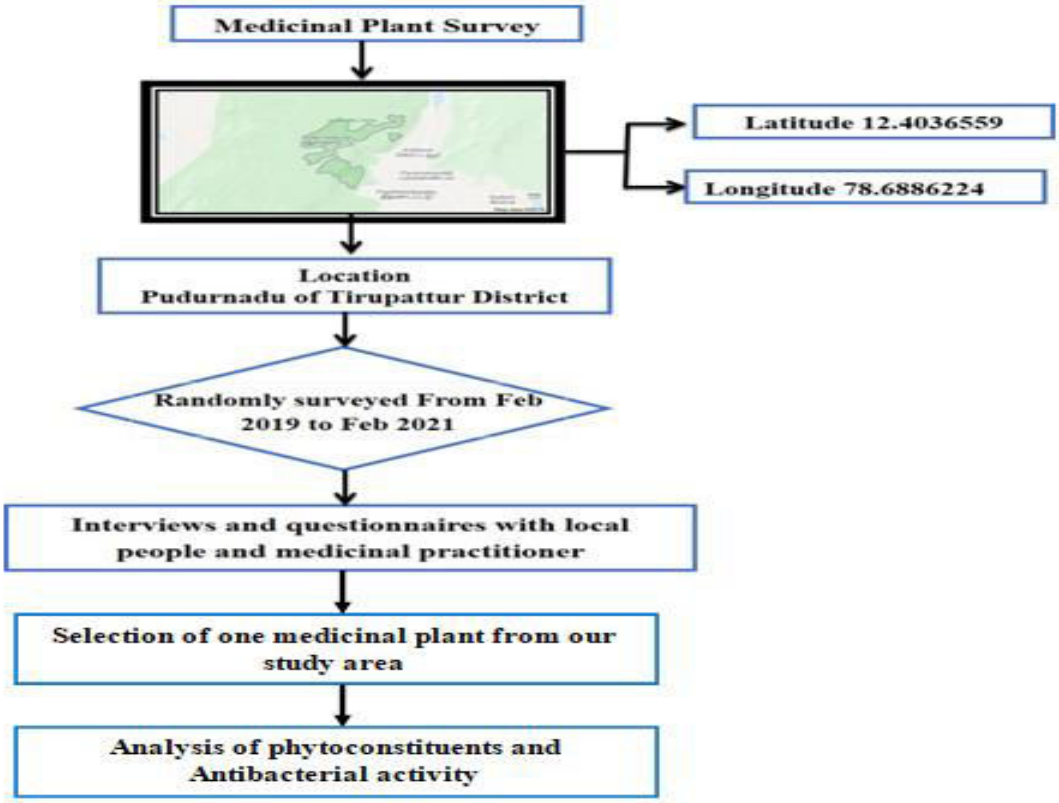

Fig. 1: Schematic diagram of work flow.

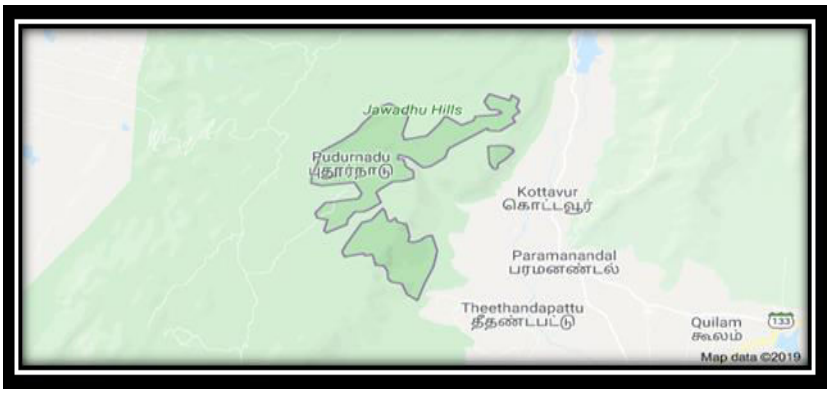

Fig. 2: Pudurnadu of Jawadhu Hills.

was added to crude extract before being gently heated. The presence of reducing sugars was indicated by the appearance of a brick-red precipitate at the test tube's bottom.

Benedict's test:

When the plants crude extract was heated with 2 ml of Benedict's reagent, a reddish-brown precipitate indicated the presence of carbohydrates.

Molisch's test:

The plant crude extract was mixed with 2ml of Molisch's reagent thoroughly, then 2 ml of concentrated sulphuric acid was poured carefully along the side of the test tube at the interphase, a

violet ring indicated the presence of carbohydrates.

Iodine test:

2 ml of iodine solution was combined with the plants crude extract. The presence of the carbohydrate was detected by a dark blue or purple colour.

Test for phenols and tannins:

The plant crude extract was combined with a 2 ml of 2% solution of Ferric chloride. The presence of phenols and tannins was indicated by a blue-green or black color.

Test for flavonoids:

Shinoda test:

A few pieces of a magnesium ribbon were combined with the plant crude extract, and then concentrated hydrochloric acid was added drop by drop. A pink scarlet colour indicated the presence of flavonoids.

Test for saponin:

In a test tube, the plant crude extract was combined with 5 ml of distilled water and quickly shaken. The formation of stable foam indicated the presence of saponin.

Test for glycosides:

Liebermann's test:

The plant rude extract was mixed with 2 ml of chloroform and 2ml of acetic acid. The mixture was kept at cooled ice then added concentrated sulphuric acid carefully. A color change from violet or blue to green indicated the presence of steroidal nucleus.

Salkowski's test:

The plant crude extract was mixed with 2 ml of chloroform. Then 2 ml of concentrated sulphuric acid was added carefully. A reddish-brown color indicated the presence of steroidal ring.

Keller-kilani test:

The plant crude extract was mixed with 2 ml of glacial acetic acid and 1 to 2 drops of 2% ferric chloride solution. The mixture was then poured into another test tube containing 2 ml of concentrated sulphuric acid. Formation of brown ring at the inter phase of the mixture indicated the presence of cardiac glycosides.

Determination Antibacterial activity:

The agar well diffusion method was used to evaluate the crude extracts for antibacterial activity and to define the zone of inhibition against the test organisms. Using only a sterile cotton swab, prepared inoculum was inoculated into sterile Mueller-Hinton agar plates. The wells in the inoculated media plate were then formed with the use of a sterile cork borer. 50 µl of working solution of various concentrations were added into the well. The control was positioned in a separate well at the same time. After the proper incubation, the plates were analyzed for the zone of inhibition, which is indicated by clear areas around the well without growth.

Results and Discussion

This research is based on a review of traditional evidence on medicinal plants from the Jawadhu Hills, Pudurnadu. This study primarily focused on plant species that were recognized for therapeutic purposes by local people from the study area. The data presented here are the overall findings of an ethnobotanical survey conducted in Pudurnadu. Herbal medicines are among the ancient forms of health benefits known to mankind. Traditional systems of medicine that have changed over the periods among many societies are still continued as a great knowledge in herbal remedies prior to the establishment of modern medicine (Mukherjee *et al*., 2006). This prosperity of great information has been given back orally from generation to generation without the use of written documents, and it is still held by diverse native tribes around the world (Perumal Samy *et al*., 1998). Interest in ethnomedicinal plants has developed around the world as a result of an increasing screening in high demand for chemical diversity and finding effective medicinal drugs from natural sources is a priority (Saranraj *et al*., 2015). Herbal medicines

are thought to be one of the earliest forms of health benefits known to menfolk. Traditional medicine maintains health by employing information, skills, and practices based on theories, beliefs, and understandings unique to each culture (Fabricant *et al*., 2001). Ethnobotanical studies are significant for the protection and usage of biological resources since they document native knowledge. The plants recorded in this survey are from the following families: Acanthaceae, Annonaceae, Aizoaceae, Alangiaceae, Alliaceae, Amaranthaceae, Anacardiaceae, Agavaceae, Apiaceae, Apocyanaceae, Araceae, Aristolochiaceae, Asclepiadaceae, Asteraceae, Basellaceae, Bombacaceae, Caesalpinacea, Capparaceae, Cucurbitaceae, Caricaceae, Cesalpinioideae, Combretaceae, Convolvulaceae, Costaceae, Crassulaceae, Cruciferae, Euphorbiaceae, Fabaceae, Gentianaceae, Labiatae, Lamiaceae, Liliaceae, Lythraceae, Malvaceae, Marsileaceae, Meliaceae, Menispermace, Mimosaceae, Moraceae, Moringaceae, Musaceae, Myrtaceae, Nymphiaceae, Oleaceae, Oxalidaceae, Papavaraceae, Papilionoideae, Piperaceae, Poaceae, Portulaceae, Rutaceae, Rubiaceae, Sapindaceae, Simaroubaceae, Solanaceae, Verbanaceae, Vitaceae, Zingiberaceae and Zygophylaceae. Around 540 lakhs indigenous people from various ethnic groups live in India's various landscapes. These indigenous peoples have their own culture, religious traditions, and eating habits, as well as extensive understanding of traditional medicine.

Even today, indigenous and tribal populations use herbal therapy to treat a variety of illnesses, with herbs being particularly useful in the treatment of snakebite (Parinitha *et al*., 2005). The depletion and evaluation of medicinal herbs are essential parts of many people. The medical system coexists with various traditional systems in most of the nations. These traditional medicinal systems are mostly founded on people's practices of using natural and local items, which are often linked to their perspective on life and the world (Toledo *et al*., 2009). Traditional uses of 146 medicinal plant species belongs to 59 families are described in this study. The local people have used the plant materials to treat various illnesses such as skin allergy, dysentery, diabetes, jaundice, asthma, fertility, antifertility, dental diseases, etc. Table 1 illustrates the medicinal plants employed and grouped alphabetically by botanical name, followed by family name, vernacular name, and medicinal purposes, while Figure 3 shows the percentage of plant components used for medicinal purpose. The phytoconstituents analysis of the methanol, ethanol and aqueous solvents extract is tested. The Methanol, Ethanol, Aqueous extracts of *B. pinnatum* was tested for the presence of phytoconstituents Alkaloids, Amino acids, Carbohydrate, Phenol, Flavonoids, Tannins, Terpenoids, Phlobatanins, Quinones and Glycoside (Table 2; Fig. 4). Saponins, which are known to have an anti-inflammatory impact, were also discovered in the plant extracts.Antibacterial properties have been reported for steroids (Just *et al*., 1998; Raquel, 2007).

Antibacterial resistance of harmful clinical bacteria is the search for new, safe, efficient, and cost-effective antimicrobial agents to use as alternative agents in the fight against infectious diseases. The zone of inhibition was measured after 24 h of incubation to determine the extent of sensitivity of the test organisms to the plant components. The antibacterial activity of *B. pinnatum* leaf extract using various extracting solvents is shown in Table 3. The results showed that the ethanol extract of *B. pinnatum* was more efficient than the other extracting solvents against the test organisms. *S. aureus* was the most susceptible to *B. pinnatum* ethanol extract (17.4±1.3 mm), whereas *P. aerginosa* was the least susceptible (8.1 ± 0.6) with positive control Ciprofloxacin (Table 3; Fig. 5). The phytochemical substances found in different plant extracts are recognized to offer health advantages, physiological activity, and therapeutic value. The antibacterial activity of several extracts from the examined plant sections was tested against different microorganisms. The zone of inhibition

Table 1: List of Medicinal Plants in Pudurnadu of Jawadhu Hills at Tamil Nadu

S. No.	Plant Name	Vernacular Name	Parts Used	Therapeutic Use
1.	*Abutilon indicum* (Malvaceae)	Thuthi	Leaf	Antimicrobial activity.
2.	*Acalypha indica* (Euphorbiaceae)	Kuppaimeni	Leaf	Leaf juice is externally used for body itching.
3.	*Achyranthes aspera* (Amaranthaceae)	Naiyuruvi	Leaf	Wounds
4.	*Adhatoda vasica* (Acanthaceae)	Adathodai	Aerial parts	Asthma, Bronchitis, Leprosy, cardiac problems, Cough, Sore eyes and Gonorrhea.
5.	*Aegle marmelos* (Rutaceae)	Vilvam	Leaf	The dried and powdered leaves are used for diabetes.
6.	*Aerva lanata* (Acanthaceae)	Sirukanpeelai	Aerial part	Leaf juice applied externally to cure chronic wounds.
7.	*Alangium salvifolium* (Alangiaceae)	Azhengil	Aerial part	Antioxidant and antimicrobial activities.
8.	*Allium cepa* (Alliaceae)	Vengaayam	Bulb onion	Onion bulb is used for diabetes.
9.	*Allium sativum* (Lilliceae)	Vellaipoondu	Leaf	Leaves Juices are used for diabetes.
10.	*Aloe vera* (Liliaceae)	Katrazai	Aerial parts	Asthma, Leprosy, heals wounds, fresh cuts, Eye diseases, Promotes menstrual flowand Jaundice.
11.	*Alternanthera sessilis* (Amaranthaceae)	Ponnakanni	Leaf	Leprosy, Skin diseases, Fever, Burning sensation, and Diarrhea.
12.	*Amaranthus artis* (Amaranthaceae)	Araikeerai	Leaf	Antimicrobial agent
13.	*Amaranthus blitum* (Amaranthaceae)	Mulaikeerai	Leaf	Antimicrobial agent
14.	*Amaranthus spinosus* (Amaranthaceae)	Mullukeerai	Leaf	Antimicrobial agent
15.	*Amaranthus viridis* (Amaranthaceae)	Kuppaikeerai	Leaf	Antimicrobial agent
16.	*Andrographis Paniculata* (Acanthaceae)	Seriyanangai or Nilavembu	Leaf	Snake bites and Liver diseases.
17.	*Anisomeles malabarica* (Labiatae)	Peruntumpai/ Peimirattihy	Aerial part	Useful for halitosis, amentia and intestinal worms.
18.	*Annona squamosa* (Annonaceae)	Seethapalam	Fruits	An anti-tumor, anti-diabetic, anti- oxidant and anti-inflammatory agent.
19.	*Argemone mexicana Linn.* (Papavaraceae)	Bramanthandu	Latex	Latex cures the ringworm infection.
20.	*Aristolochia bracteolate* (Aristolochiaceae)	Aaduthinnappalai	Leaf	For diabetes leaf juice is taken orally.
21.	*Artocarpus hirsutus* (Moraceae)	Kattupala	Fruit	Seed with honey used to treat asthma, Fruits used as appetizer.
22.	*Asparagus racemosus* (Liliaceae)	Thaneervitan Kizhangu	Root	Stomach(dyspepsia), Constipation, stomach spasms, and stomach ulcers.
23.	*Azadirachta indica* (Meliaceae)	Veempu (Neem)	Leaf	Leaves used for diabetes.
24.	*Basella alba* (Basellaceae)	Kodipasalai	Leaf	Antimicrobial and Anticancer gent
25.	*Betel piper Linn.*	Vetrilai	Leaf	Leaves vermifuge, antiseptic,

	(Piperaceae)			anti-diabetics, astringent, antiperiodic.
26.	*Blepharis medaraspatensis* (Acanthaceae)	Elumbuotti	Seeds	Cures the diseases of nervous system, diuretic, aphrodisiac
27.	*Brassica juncea* (Cruciferae)	Kaduku	Leaf Seeds	Eye diseases
28.	*Bryophyllum pinnatum* (Crassulaceae)	Malaikalli/ Ranakalli	Leaf	Analgesic, carminative and also useful in diarrhoea and vomiting.
29.	*Caesalpinia bonduc* (Cesalpinioideae)	Karchuram	Aerial part	Fever, jaundice, arthritis, worms, flatulence, dyspepsia, splenomegaly and diabetes.
30.	*Cajanus cajan* (Fabaceae)	Thovaray	Seed	Gingivitis and stomatitis.
31.	*Calotropis gigantean* (Asclepiadaceae)	Erukkam	Latex	Cure rheumatic pain and swellings.
32.	*Cardiospermum halicacabum* (Sapindaceae)	Mudakkaththan	Leaf	Rheumatic arthritis
33.	*Carica papaya* (Caricaceae)	Pappali	Leaf, fruits	Tuberculosis and regulates menstrual flow.
34.	*Cassia alata* (Cesalpinioideae)	Seemaiakathi	Leaf	Ringworm patches and eczema.
35.	*Cassia auriculata* (Caesalpinacea)	Avaram	Flower	Fever, Diabetes and Urinary infections.
36.	*Cassia fistula* (Cesalpinioideae)	Sarakondrai, Konnei	Aerial part	Bark decoction given to cattle as purgative.
37.	*Cassia obtuse* (Cesalpinioideae)	Nilaavarai	Leaf	Antimicrobial agent.
38.	*Cassia roxburghii* (Cesalpinioideae)	Sennkondrai	Leaf	Hepato protective activity.
39.	*Cassia tora* (Cesalpinioideae)	Tagarai	Aerial part	Chronic inflammation of the skin and other skin diseases and malaria
40.	*Catharanthus roseus* (Apocyanaceae)	Nithyakalyani	Aerial parts	Antimicrobial and Anticancer agent.
41.	*Ceiba pentandra* (Bombacaceae)	Ilavam	Aerial part	Diuretic, antipyretic, gonorrhea and tumors.
42.	*Celosia argentea* (Amaranthaceae)	Pannaikeerai	Leaf	Antimicrobial activity.
43.	*Centella asiatica* (Apiaceae)	Vallari	Aerial parts	Antimicrobial activity and Increase the memory power.
44.	*Cichorium intybus* (Asteraceae)	Kasinikeerai	Leaf	Antimicrobial activity.
45.	*Cissus quadrangularis* (Vitaceae)	Pirandai	Aerial Parts	Heart diseases, diabetes and metabolic Syndrome
46.	*Citrus limon (Linn.)* (Rutaceae)	Elumichai	Fruit	Fruit for nail infection and juice induces body freshness.
47.	*Cleome gynandra* (Capparaceae)	Nalvelai	Leaf	Toothache
48.	*Clitoria ternatea* (Fabaceae)	SanguPushpam	Leaf	Antimicrobial activity, Eye diseases and Headache.
49.	*Coccinia grandis* (Cucurbitaceae)	Kovai	Leaf	Eye diseases
50.	*Colocasia esculenta* (Araceae)	Shaepamkizhangu	Leaves	Leaves used for diabetes

51.	*Coriandrum sativum* (Apiaceae)	Kothamalli	Leaf	Antimicrobial agent
52.	*Costus igneus* (Costaceae)	Kostum	Leaves	Leaf juice used for diabetes
53.	*Crateva adansonii* (Capparaceae)	Mavelangam	Leaf	Fever, acrid and cough
54.	*Cucurbita moschata* (Cucurbitaceae)	Poosani	Leaf and Fruits	Burns and Inflammations.
55.	*Curcuma longa* (Zingiberaceae)	Kasturimanjal	Rhizome	Rhizome is used for diabetes
56.	*Cynodon dactylon* (Poaceae)	Arugampul	Whole plant	Antimicrobial and Diabetes.
57.	*Datura metel* (Solanaceae)	Vellaiumattai	Whole plant	Antimicrobial and anticancer agent.
58.	*Datura stramonium* (Solanaceae)	Umattai	Whole plant	Antimicrobial and anticancer agent.
59.	*Eclipta alba* (Asteraceae)	Karisalankanni	Leaf	Leaf is used for Diabetes
60.	*Eclipta procera* (Asteraceae)	Mangel Karisalankanni	Whole plant	Antibacterial and Jaundice.
61.	*Enicostemma littorale* (Gentianaceae)	Vellaruku	Leaf	Leaves used for diabetes.
62.	*Ervatamia divaricate* (Apocyanaceae)	Nantiyavarttam	Leaf	Antibacterial and antifungal agent
63.	*Erythrina indica Lam.* (Fabaceae)	Kalyanamurungai	Leaf	For body pain, headache, fever and cold.
64.	*Eucalyptus globules* (Myrtaceae)	Neelagri	Leaf	Lighten body pain
65.	*Euphorbia hirta* (Euphorbiaceae)	Amman pacharisi	Leaf	Used for diabetes.
66.	*Ficus benghalensis* (Moraceae)	Aalamaram	Bark	Bark decoction is used for diabetes.
67.	*Ficus racemosa* (Moraceae)	Atthi	Root	Decoctiontaken for diabetes.
68.	*Ficus religiosa* (Moraceae)	Arasu	Leaf	Antibacterial agent.
69.	*Furcraea foetida* (Agavaceae)	Pachaikatrazhai	Leaf	Anti-inflammatory and wound healing.
70.	*Gisekia pharnaceoides* (Aizoaceae)	Manalikkirai	Aerial parts	Antibacterial activity.
71.	*Glycyrrhiza glabra* (Fabaceae)	Athimathuram	Root	It is good for skin whitening as this has the minerals and several acids that help to get rid of the dark skin color.
72.	*Gymnema sylvestre* (Apocyanaceae)	Sakkaraikolli	Leaf	Used for diabetes.
73.	*Hemidesmus indicus* (Asclepiadaceae)	Nannari	Aerial parts	Fever and Skin diseases
74.	*Hibiscus cannabinus* (Malvaceae)	Pulichakeerai	Leaf	Antimicrobial activity.
75.	*Hibiscus rosasinensis* (Malvaceae)	Semparuthi	Leaf Flower	Cure hair problems and induce hair growth.
76.	*Hygrophila auriculata* (Acanthaceae)	Nirmulli	Leaf and Seed	Leaf used for cough, seeds increase male fertility.
77.	*Hyptis suaveolens* (Lamiaceae)	Kattutulsi	Root decoction	Appetizer
78.	*Ipomoea batatas*	Sakaraivalli	Tubers	Tubers boiled and taken to treat

	(Convolvulaceae)			diabetics.
79.	*Ixora coccinea* (Rubiaceae)	Idlipoo/ Sinduram	Leaf Flower	Liver toxicity.
80.	*Jasminum angustifolium* (Oleaceae)	KattuMalligai	Root and flower	Skin problems, ulcers and eye diseases.
81.	*Jatropha gossypifolia* (Euphorbiaceae)	Kadalamanakku	Whole plant	Toothache and Headache.
82.	*Justiciatran canariensis* (Acanthaceae)	Sivanarvembu	Leaf	Swelling and snake bites.
83.	*Lablab purpureus* (Papilionoideae)	Avarai	Leaf	Antimicrobial and anti-inflammatory agent.
84.	*Lactuca sativa* (Asteraceae)	Manalikeerai	Leaf	Antimicrobial agent.
85.	*Lagenaria siceraria* (Cucurbitaceae)	Sorakkai	Leaf	Used for Cough, Bronchitis, Asthma, Fever, Inflammations, Leprosy, Skin diseases and Jaundice.
86.	*Lantana camara* (Verbenaceae)	Unnichedi	Leaf	Improves digestion
87.	*Lawsonia inermis* (Lythraceae)	Maruthani	Leaf	Antimicrobial agent and healing of the crack.
88.	*Leucas aspera* (Labiatae)	Thumbai	Leaf	Treat bronchitis in children.
89.	*Limonia acidissima* (Rutaceae)	Paambukalasedi	Leaf, fruit, seed, bark and root	Treatment of excessive menstruation, liver disorders, bites and stings, and nausea.
90.	*Lucas aspera spreng.* (Lamiaceae)	Thumbai	Leaf	Prevents tooth and gum infections.
91.	*Mangifera indica* (Anacardiaceae)	Maamaran	Leaf	Used for diabetes.
92.	*Marsilea minuta* (Marsileaceae)	Aarakeerai	Leaf	Antimicrobial and Diabetes.
93.	*Melia azedarach* (Meliaceae)	Malaivembu	Seed	Used for diabetes.
94.	*Melochia corchorifolia* (Malvaceae)	Pinnakukeerai	Leaf	Antimicrobial activity.
95.	*Mentha arvensis* (Lamiaceae)	Pudhina	Leaf	Antimicrobial activity
96.	*Millettia pinnata* (Fabaceae)	Pungamaram	Flowers	anti-diabetic action
97.	*Mimosa pudica* (Mimosaceae)	Thottasurungi	Leaf	Wounds
98.	*Mollugocerviana* (Aizoaceae)	Parpadakam	Aerial part	Treat fever.
99.	*Momordica somnifera* (Cucurbitaceae)	Pavakai	Leaf and Fruit	Antimicrobial, Antioxidant and Antidiabetic activity.
100.	*Morinda coreia* (Rubiaceae)	Nuna	Leaf	Antibacterial activity.
101.	*Moringa oleifera* (Moringaceae)	Murungai	Leaf	Anemia, Arthritis, Asthma, Cancer and constipation.
102.	*Mukia maderaspatana* (Cucurbitaceae)	Musumusukai	Leaf	Ulcers, Cough, Asthma, Neuralgia, Notalgia, Odontalgia and Vertigo.
103.	*Murraya koenigii* (Rutaceae)	Karuveppilai	Leaf	Dysentery, blood purifier, tuberculosis and burning pain.
104.	*Musa paradisiaca* (Musaceae)	Vaalai	Stem	Juice is obtained from stem is taken orally to dissolve the

				Kidney stone.
105.	*Nelumbo nucifera* (Nymphiaceae)	Senthamarai	Flower	Used for diabetes.
106.	*Nerium oleander* (Apocynaceae)	Arali	Fruit	Ear pain
107.	*Ocimum basilicum* (Labiatae)	KarpuraThulasi	Leaf	Used for ear pains.
108.	*Ocimum sanctum* (Labiatae)	Thulasi	Leaf	Used for cough.
109.	*Oxalis corniculata* (Oxalidaceae)	Pulichchakeerai	Leaf	Antimicrobial agent.
110.	*Pergularia daemia* (Asclepiadaceae)	Uttamani	Leaf	Used for body pain.
111.	*Phyllanthus amarus* (Euphorbiaceae)	Keelanelli	Leaf	Used for diabetes.
112.	*Phyllanthus emblica* (Euphorbiaceae)	Nellikkaai	Fruit	Fruits are very good antioxidant properties.
113.	*Piper nigrum L* (Piperaceae)	Milagu	Seed	Reduce throat infection, cold and cough.
114.	*Pistiastragiotes* (Araceae)	Akayattamarai	Aerial parts	Bladder complaints, Diabetes, Dysentery and Anemia.
115.	*Plectranthus amboinicus* (Lamiaceae)	Karpuravalli	Leaf	Antimicrobial activity
116.	*Plumeria obtuse L.* (Apocynaceae)	Thevarali	Latex	Used as a mouth wash and cures mouth ulcer.
117.	*Plumeria rubra* (Apocyanaceae)	SegappuArali	Leaf	Ulcers, Pruritus, Leprosy
118.	*Polyalthia longifolia* (Annonaceae)	Nettilinkam	Leaf	Fever, gonorrhea, heart problems and blood pressure.
119.	*Portulaca oleraceae* (Portulaceae)	Paruppukeerai	Leaf	Antimicrobial agent.
120.	*Portulaca quadrifida* (Portulaceae)	Pasalaikeerai	Leaf	Antimicrobial agent.
121.	*Premna integrifolia* (Verbanceae)	Mullai	Root, leaves, Bark	Neuralgia, Arthritis, Common cold.
122.	*Psidium guajava* (Myrtaceae)	Koiyaa	Fruit	Used for diabetes.
123.	*Pterocarpus marsupium* (Papilionoideae)	Vengai	Aerial part	Leprosy, fractures, skin diseases, diabetes cough and asthma.
124.	*Punica granatum* (Lythraceae)	Madulai	Flower	Used for diabetes.
125.	*Rhinacanthus nasutus* (Acanthaceae)	Nagamalli	Leaf	Treat toothache.
126.	*Ricinus communis* (Euphorbiaceae)	Amanakku	Seed	Used to cure fever.
127.	*Sesbania grandiflora* (Papilionoideae)	Agathei	Leaf	Sinus, Diabetes, Fever and Malaria
128.	*Simarouba glauca* (Simaroubaceae)	Lakshmi maram/ Sorkkamaram	Leaves and bark	Treatment of malaria, fevers and dysentery.
129.	*Solanum nigrum* (Solanaceae)	Manathakalli	Aerial parts	Antimicrobial activity.
130.	*Solanum torvum* (Solanaceae)	Sundai	Aerial parts	Skin diseases, Inflammations, Urinary retention and Kidney stones.
131.	*Solanum trilobatum* (Solanaceae)	Thuthuvalai	Leaf	Antimicrobial agent and Cough.

132.	*Spermacoce hispida* (Rubiaceae)	Nathachuri	Leaf	The powered leaves are taken twice daily.
133.	*Spinacea oleracea* (Amaranthaceae)	Palakeerai	Leaf	Antimicrobial activity.
134.	*Syzygium cumini* (Myrtaceae)	Naval Palam	Seed	Used for diabetes.
135.	*Tamarindus indica* (Cesalpinioideae)	Puli	Fruit	Used to cure muscle swelling.
136.	*Terminalia arjuna* (Combretaceae)	Maruthamaram	Whole plant	Asthma and bile duct disorders
137.	*Thespesia populnea* (Malvaceae)	Puvaracu	Leaf	Skin disease
138.	*Tinospora cordifolia* (Menispermacee)	Seenthil	Leaf	Treat piles
139.	*Trachyspermum ammi* (Apiaceae)	Omam/Ajwain	Seeds	Used for abdominal discomfort and used as antiseptic.
140.	*Tribulus lanuginosis* (Zygophylaceae)	Nerungi	Fruit	Seed powder used to increase fertility and sperm production.
141.	*Tridax procumbens* (Asteraceae)	Kenatrupasan/ Vettukayapoondu	Leaf	Healing wounds.
142.	*Trigonella foenum* (Fabaceae)	Vendhayakeerai	Leaf	Antimicrobial agent.
143.	*Typhonium trilobatum* (Araceae)	Karunaikizhangu	Whole plant	Antibacterial agent.
144.	*Vigna mungo* (Papilionoideae)	Oolunthu	Aerial part	Rheumatism and Liver diseases.
145.	*Vitex negundo* (Verbanaceae)	Nochi	Leaf	Headache and Sinus problem.
146.	*Withania somnifera* (Solanaceae)	Ashwagandha	Whole plant	Antimicrobial agent, Hypertension, and used for asthma.

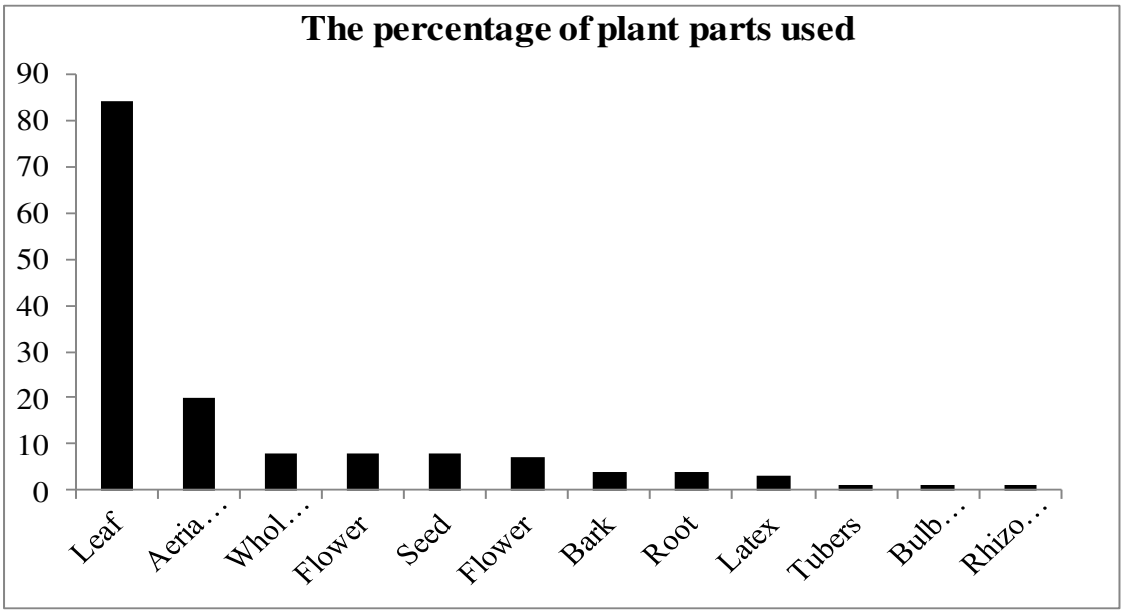

Fig. 3: Plant parts used for medicinal purpose.

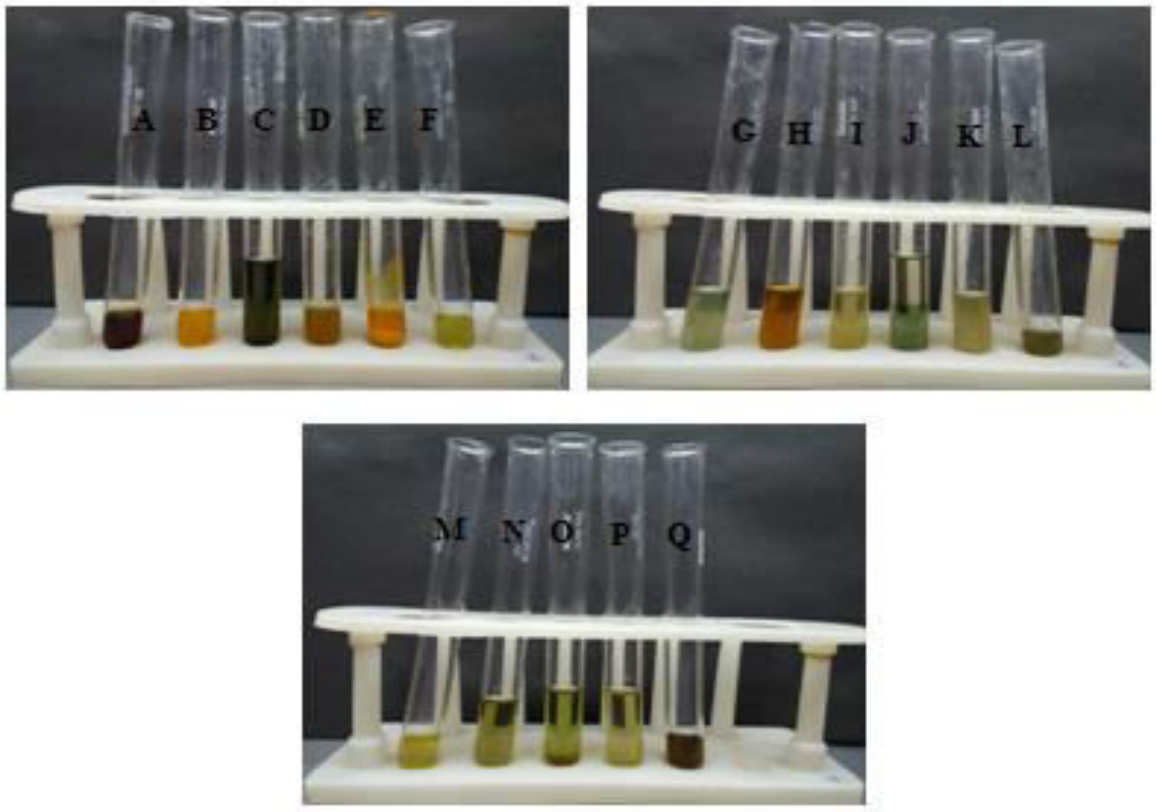

Fig. 4: Phytochemical screening of Ethanolic extract. **A**= Wagners test, **B** = Xanthoprotein test, **C**= Molish test, **D** =Ferricchloride test (phenol), **E** = Potassiumdichromate test, **F** = Alkaline reagent test, **G** =Ammonia test, **H** =Ferricchloride test(tannins), **I** =Foam test, **J** =Libermannburchard test, **K** =1% Hydrochloric acid test, **L** =Hydrochloric acid test, **M** =Sodium hydroxide test, **N** =Glacial acetic acid test, **O** =Keller killiani test, **P** =Test for glycoside and **Q** =Sulphuric acid test.

Table 2: Phytoconstituents of *Bryophyllum pinnatum* leaf extract using different extracting solvents

Constituents	Methanol extract	Ethanol extract	Aqueous extract
Alkaloids	+	+	+
Aminoacid	+	+	+
Carbohydrate	+	+	+
Phenol	+	+	+
Flavonoid	+	+	+
Tannins	+	+	–
Saponin	+	+	+
Terphenoids	+	+	+
Phlobatanins	–	–	–
Quinones	+	+	–
Steroid	–	–	–
Glycoside	+	+	+

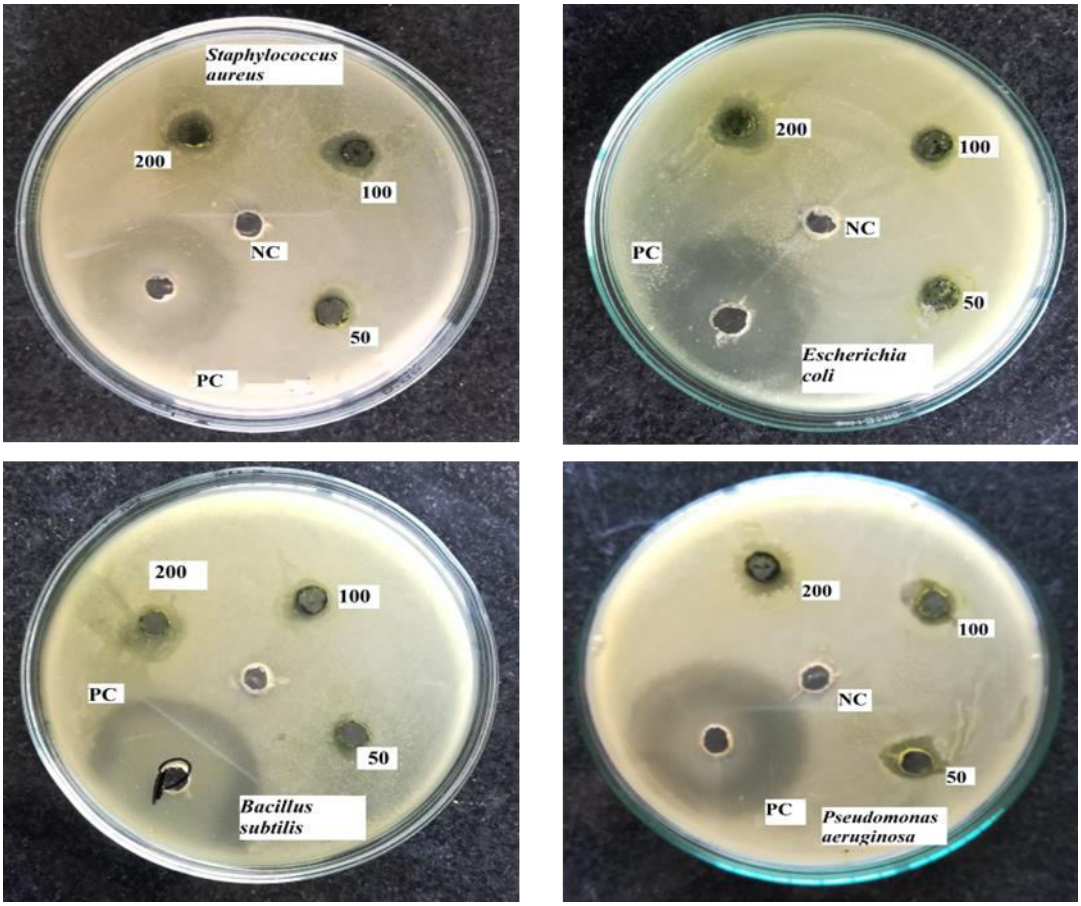

Fig. 5: Growth inhibition by plant extract with positive control and negative control.

Table 3: Antimicrobial activity of *Bryophyllum pinnatum* leaf extract using different extracting solvents (Zone of inhibition in mm)

Test organisms	Ciprofloxacin	Aqueous extract	Ethanol extract	Methanol extract
S. aureus	27.0	11.2 ± 0.8	17.4 ± 1.3	12.6 ± 0.7
E. coli	32.0	8.7 ± 0.4	12.5 ± 0.7	9.1 ± 0.8
B. subtilus	26.0	0.0 ± 0.0	9.7 ± 0.8	6.3 ± 0.6
P. aeruginosa	29.0	0.0 ± 0.0	8.1 ± 0.6	4.8 ± 1.0

was measured after 24 h of incubation to determine the extent of sensitivity of the test organisms to the plant extracts. The presence of diverse active phytoconstituents made the test organisms sensitive, resulting in varying antibacterial activity of the extracts against different bacteria. The antimicrobial effect of the plant's various crude extracts was investigated, and it was discovered that the extracts exhibit broad spectrum antibacterial activity. The ethanolic extract of the plant showed significant antibacterial action against both gram positive and gram-negative microorganisms.

Conclusion

The Pudurnadu of Jawadhu Hill in Tamil Nadu, India is abundant with numerous plants, according to this survey. Villagers continue to use the medicinal plants on the hill for a variety of ailments. The hills biodiversity should be researched and maintained in the future. Many therapeutic plants availability and presence were

studied and validated through this ethnobotanical survey. We observed that these plants are used in medications for pharmacologically obscure parts of India and they could be used to improve human health. Within the scope of existing remedies, this study provided the relationship between people and plants. This research also acquired a wide range of data on medicinal plants utilized by the residents of the Jawadhu Hills. According to the survey, the study region offers a vast array of medicinal plants that may be used to cure a wide range of human problems. The result of interviews conducted in villages included Pudurnadu, Pungampattunadu, Poongulam and Kavalur reserve forest. Traditional local practitioners and herbalists who live in rural regions and collect medicinal plants from the Jawadhu Hills are the only ones who know about medicinal plants. As a result, it is critical to assess the biodiversity of the local forest, as well as to support biodiversity and traditional knowledge through effective documentation and conservation methods.

The result of the phytochemical screening revealed that tannin, alkaloids, flavonoids, were present in both ethanolic and methanolic extracts whereas phlobatannins and steroids are absent in these extracts. Combinations of extracts have additive effects on microorganisms, as per this study. Microbial tolerance is less likely to develop against drugs with several different mechanisms of action, therefore the interaction is better. The presence of multiple active natural plants made the test organisms sensitive, resulting in varying antibacterial activity of the extracts against different bacteria and fungi. To prevent medication resistance and cure new and re-emerging diseases caused by bacterial and fungal species, it is advised that the synergistic use of medicinal plant extracts be encouraged.

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