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A Review on Polyherbal Used in Herbal Handwash Having Antimicrobial Activity

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ABSTRACT

Herbal medicine, the backbone of traditional medicines in many countries, have played an important role in curing the diseases of humans since ancient time. Plants synthesize hundreds of chemical compounds for various functions including defense and protection. The present review compiles on the ethnopharmacological and pharmacological properties of various herbs that tend to be useful in the formulation of hand wash. Handwashing is the important activity that have practised in today's infectious world, as microorganisms are in first contact with the skin. Hand touches and forwards to contact with foreign particles. So for, its prevention from other chemically synthesized hand washes, the herbal hand wash paves way for the healthy and infectious-free world. Currently, market is flooded with many synthetic handwash that contains heavy metals like lead, nickel, copper, chromium, arsenic and cobalt and while applying these, some of those toxic substances get absorbed by hands. To avoid such chemical utility outcomes, herbal formulations are produced. The study of different herbs in the article states the potency of plant constituents against microorganisms. The herbs specifically controls the microorganisms attack to the skin and they showed as potent herbs in the formulation of handwash.

INTRODUCTION:

Herbal medication, known as “Botanical treatment” or “Phyto-medicine”, refers to the utilization of any plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. An herbal drug treatment offers a healthy life, and it is generally used to furnish first-line and common health suppliers. Since ancient times in India, herbal medicines have been the basis of treatment and cure for numerous diseases. Physiological conditions are practiced in traditional methods such as Ayurveda, Unani, and Siddha. Herbal medicines have numerous therapeutic uses including healing wounds, treating inflammations because of infection, skin lesions, leprosy, diarrhea, scabies, venereal diseases, snakebite, and ulcers, etc.

Hands are the primary mode of transmission of microbes and infection. Hand hygiene is one of the most important measures to prevent harmful bacterial infections and to prevent infection. Hand washing is the act of germless hands to remove soil, dirt, and pathogenic microorganisms, and avoid transmitting of transient microorganisms. It removes visible dirt from hands and reduces the number of harmful microorganisms such as *Escherichia coli* and *Salmonella species* carried by people, animals, or equipment and transmitted to food. To defend the skin from harmful microorganisms and to avoid the spreading of various contagious diseases, hand washing is an extremely important precaution. [(1)]

The present review focuses on the various list of herbs comprising various pharmacological properties and its efficacy against harmful microorganisms that can be fatal. The alcohol-based sanitizers are prepared synthetically and may have a high chance of major side effects on the skin. The present study aims at the pharmacological properties of various herbs that could serves for the formulation of a herbal hand wash.

PLANT PROFILE: 1

Botanical name	*Vitex negundo*
Kingdom	Plantae
Division	Mangnoliophyta
Class	Mangnoliopsida
Order	Lamiales
Family	*Verbenaceae*
Genus	Vitex
Species	*Vitex negundo*
Habitat	South and southeast Asia

Figure No: 1 *Vitex negundo*

Vitex negundo (Figure-1) is a woody, erect and deciduous shrub that grows to a small tree of height 2 to 8 m in height. The bark is reddish brown in colour. The leaves are pentafoliate, and the leaflets are arranged palmately. The terminal leaflets are 4-10 cm long, acute shaped with petiolate (1-1.3 long), lanceolate, hairy beneath and both the ends are pointed. The flowers are numerous which are bluish purple in colour and is branched in tomatoes cymes and the fruits are round, succulent and black on ripening with four seeds. The plant extract shows the presence of volatile oil, triterpenes, diterpenes, sesquiterpenes, lignan, flavonoids, flavones, glycosides, iridoid glycosides and stilbene derivatives. It also contains vitamin c, carotene, casticin, luteolin,vitexin caffeate, viridifloral, linalool, hexadecenoic acid. The plant is used in traditional herbal medicine for women's health, including treatments for regulating the menstrual cycle, fibrocystic breast disease and post- partum remedies. It is reported to have various pharmacological properties such as anxiolytic, analgesic, nephroprotective, antibacterial, anti-cancer, anti-inflammatory, antipyretic, and antioxidant activities[2,3].

Kamruzzaman M *et al* investigated *in vitro* and *in vivo* antibacterial potentials of water and methanol extracts of leaves of *Vitex negundo* against various pathogenic enteric bacteria such as *Vibrio cholerae*, *Vibrio parahaemolyticus*, *Vibrio mimicus*, *Escherichia coli*, *Shigella species*, and *Aeromonas species* using disc diffusion, viable bacterial cell count methods, minimum inhibitory concentrations and minimum bactericidal concentrations determinations. The methanol extract of *Vitex negundo* leaves showed potent antibacterial activity against all the tested enteric bacterial pathogens. Deogade MS *et al* evaluated the *In-vitro* antimicrobial potential of ethanol extract of *Vitex negundo* Linn. leaves on both gram-positive and gram-negative organisms such as *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella pneumoniae* by well diffusion method. It has been reported that the maximum zone of inhibition observed for *Staphylococcus aureus* was 15 mm at the concentration of 80 mg/ml

and 100 mg/ml, and at 100 mg/ml concentration, the maximum zone of inhibition observed for *Escherichia coli* and *Klebsiella pneumoniae* was 12 mm and 11 mm. Therefore, the study revealed that the leaf extract of *Vitex negundo* Linn possessed significant antimicrobial activity against all the bacteria pathogens tested[4,5].

PLANT PROFILE: 2

Botanical name	*Psidium guajava*
Kingdom	Plantae
Order	Myrtales
Family	*Myrtaceae*
Genus	Psidium
Species	*Psidium guajava*
Habitat	Tropical and Sub-tropical locations

Figure No: 2 *Psidium guajava*

Psidium guajava (Figure 2) is a large dicotyledonous shrub, or small evergreen tree, generally 3 to 10 m high with many branches. The stems are crooked and the bark is light to reddish brown in colour with thin, smooth and continuously flaking. The root system is superficial and extends well beyond the canopy. The flowers are white, incurved petals, 2 or 3 in the leaf axils; they are fragrant, with four to six petals and yellow anthers. The fruit is small, 3 to 6 cm long, pear-shaped, reddish-yellow when ripe. The fruit contains several small seeds and consists of a fleshy pericarp and seed cavity with pulp. The plant contains a broad spectrum of phytochemicals including minerals, enzymes, proteins, sesquiterpenoid alcohols and triterpenoid acids, alkaloids, glycosides, steroids, flavonoids, tannins, and saponins. It is highly rich in antioxidants and vitamins, and in lutein, zeaxanthine and lycopene. It contains

both carotenoids and polyphenols like gallocatechin, guaijaverin, leucocyanidin and amritoside. The fruit of the plant contains ursolic acid, oleanolic acid, arjunolic acid and glucuronic acid. It is used as an analgesic in painful menstruation, miscarriages, uterine bleeding, premature labor and wounds. It is used to treat bronchitis, asthma attacks, and pulmonary attacks. *Psidium guajava* is reported to have various pharmacological properties such as antioxidant, hepatoprotective, anti-allergy, antimicrobial, antigenotoxic, antiplasmodial, cytotoxic, antispasmodic, cardioactive, anticough, antidiabetic, anti-inflammatory and antinociceptive activities[6,7].

Biswas B *et al* evaluated the antimicrobial activity of leaf extracts of *Psidium guajava* against two gram-negative bacteria such as *Escherichia coli* and *Salmonella enteritidis* and two gram-positive bacteria such as *Staphylococcus aureus* and *Bacillus cereus*. Various extracts such as hexane, methanol, ethanol and water of the leaf of the plant were tested against bacterial species using agar well diffusion method. The methanol leaf extract showed an antibacterial activity with zones of inhibition of 8.27 and 12.3 mm, and the ethanol extract showed a mean zone of inhibition of 6.11 and 11.0mm against *Bacillus cereus* and *Staphylococcus aureus*. The report revealed that the methanol and ethanol leaf extracts of *Psidium guajava* showed inhibitory activity against gram-positive bacteria, and proved the antimicrobial properties of the plant. Pereira GA *et al* analyzed the antimicrobial activity of the aqueous extract of *Psidium guajava* leaves against Gram-positive bacterial strains such as *Staphylococcus aureus*, sensitive and resistant; *Staphylococcus pseudintermedius*, sensitive and resistant; and *Streptococcus spp*., beta-hemolytic) and Gram-negative bacterial strains such as *Escherichia coli*, sensitive and resistant the disk diffusion and broth microdilution methods. The results revealed the presence of inhibition halos for Gram-positive bacteria and Gram-negative bacteria showed no inhibition in the tested concentration range. The Minimal Inhibitory Concentration was 6.8 mg/mL for all Gram-positive strains evaluated. The study demonstrated the antimicrobial activity of the aqueous extract of *Pisidium guajava* against sensitive and resistant Gram-positive bacteria[8,9].

PLANT PROFILE: 3

Botanical name	*Coriandrum sativum*
Kingdom	Plantae
Division	Mangnoliophyta
Class	Mangnoliopsida
Order	Apiales
Family	*Apiaceae*
Genus	Coriandrum
Species	*Coriandrum sativum*
Habitat	Eastern Mediterranean, Central and Eastern Europe

Figure No: 3 *Coriandrum sativum*

Coriandrum sativum (Figure-3) has a height range between 20 and 140 cm, depending on the agroclimatic conditions. Leaves are oval, slightly lobed and sections of the upper leaves are linearand more divided. The stem is erect, thin, sympodial, monochasial and branched with several side branches at the basal node. Each branch ends with an inflorescence. The flowers are small, shortly stalked umbels, pinkish and whitish in color. The roots are spindle-shaped. The fruits are globular or ovate, consisting of two pericarps, with a diameter of up to 6 mm. The main components of immature fruits were geranyl acetate, linalool, nerol and neral. Fruits in the middle stage contain mainly linalool, cis-dihydocarone and geranyl acetate. Predominant component of mature fruits includes linalool and cis-dihydocarone.The plant is used as a flavoring agent and as a traditional remedies for the treatment of different disorders in the folk medicine systems of different civilizations. It has reported to have various pharmacological properties such as, anti-microbial, anti-oxidant, anti- diabetic, anxiolytic,

anti-epileptic, anti-depressant, anti-mutagenic, anti-inflammatory, anti- dyslipidemia, anti-hypertensive, neuro-protective and diuretic. It also possessed lead-detoxifying potential [10,11].

Sambasivaraju *et al* studied the antibiotic sensitivity testing for the coriander oil against bacterial species such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella*, *Pseudomonas* and *Salmonella* using the Kirby-Bauer disk diffusion method. Among the tested microorganisms, oil showed the highest activity against *Escherichia coli* than other species. Therefore, coriander oil was found to have good antibacterial activity against the tested microorganisms. Ali *et al* studied the antimicrobial activity of the leaf and seed extracts of *Coriandrum sativum* assessed towards bacterial strains such as Salmonella typhi and Staphylococcus aureus, yeast such as *candida* and fungal strains such as *Aspergillus flavus*, *Mucor sp* and *Emericella nidulans*. The results revealed that the extract of coriander seeds has the highest activity towards the tested microorganisms[12,13].

PLANT PROFILE: 4

Botanical name	*Sapindus mukorossi*
Kingdom	Plantae
Division	Magnoliophyte
Class	Magnoliopsida
Order	Sapindales
Family	*Sapindaceae*
Genus	Sapindus
Species	*Sapindus mukorossi*
Habitat	Tropical and subtropical region of Asia

Figure No: 4 *Sapindus mukorossi*

Sapindus mukorossi (Figure-4) is a large, deciduous tree with a straight trunk upto 12m in height, with a globose crown. The bark is dark to pale yellow, smooth in irregular wood scales. Leaves are 30-50 cm along, alternate with common petiole; leaflets 5-10 pairs inflorescence is a compound terminal panicle, 30 cm in length. Flowers are 5 mm, small polygamous, greenish white, mostly bisexual. Seeds are 0.8-1.3 cm in diameter, globose smooth black. The major constituents of the fruit are saponins (10%-11.5%), sugars (10%) and mucilage. Saponins are secondary plant metabolites with divergent biological activities. Sapindus saponins are a mixture of six sapindosides (sapindosides A, B, C, D and mukorozi saponins (E1 and Y1), with sapindoside B as one of the major constituents, Differenttypes of triterpenes, saponins of oleanane, dammarane and tirucullane were isolated. The roots of Sapindus mukorossi contain tirucallane-type triterpenoid saponins like Sapimukoside A & B, Sapimukoside C&D. It is a popular ingredient of ayurvedic preparation and medicine for the treatment of eczema, psoriasis and for removing freckles, and have gentle insecticidal property and traditionally used for removing lice from the scalp. S. mukorossi is reported for various pharmacological properties such as antibacterial, insecticidal, spermicidal, anti-trichomonas, anti-cancer, hepatoprotective, anxiolytic, molluscicidal, fungicidal, anti-inflammatory, Piscicidal, anti-platelet aggression activities [14,15,16].

George B *et al* studied the antimicrobial activity of ethanol and aqueous extracts of the pericarp of *Sapindus mukorossi* against bacterial strains such as *Escherichia coli* and *Staphylococcus aureus*, and fungal strains such as *Aspergillus niger* and *Aspergillus fumigate* using disc diffusion method. The report revealed that the ethanol extract of the plant had prominent antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* than aqueous extract, and the ethanol extract showed antifungal activity against *Aspergillus fumigates* and *Aspergillus Niger*. Eren MM *et al* evaluated the antimicrobial activity of saponins from hexane, ethylacetate and methanol extracts of fruits of *Sapindus mukorossi* against *Streptococcus mutans* and *Enterococcus faecalis* by the broth microdilution method. All the extracts of the plant showed inhibitory activity against the tested microorganisms. The study revealed that the saponins extracted from *Sapindus mukorossi* have a potential antibacterial activity against the tested pathogens[17,18].

PLANT PROFILE: 5

Botanical name	*Acalypha indica*
Kingdom	Plantae
Division	Angiosperms
Class	Eudicots
Order	Malpighiales
Family	*Euphorbiaceae*
Genus	Acalypha
Species	*Acalypha indica*
Habitat	Tropical and Subtropical regions

Figure No: 5 *Acalypha indica*

Acalypha indica (Figure-5) is a herbal plant that grows in wet, temperate and tropical region, primarily along the earth's equator line. The leaves are simple, arranged spirally; 0.02 – 12.00 cm petiole long; blade broadly ovate to ovate-lanceolate; 2-9 cm sparingly short hairs to almost glabrous in nature. The stem is sparing to densely hairy. The flowers are arranged in numerous erect, lax, elongated, white colour, scattered and surrounded by leaf dentate that is approximately 6-8 mm in diameter. The plant has wide variety of nutrients such as carbohydrates, proteins, vitamins, and lipids. The list of secondary metabolites is acalyphamide, acaindinin, caffeic acid, cysteine, ferulic acid, gallic aid, tectoquinone, triacetonamine, corilagin, ellagic acid, geraniin, stigmasterol. It has been reported to show various pharmacological properties such as analgesic, anthelmintic, anti-bacterial, anti-cancer, anti-diabetic, anti-fungal, anti-inflammatory, anti-obesity, antioxidant, anti-ulcer, anti-venom, anti-viral, wound healing activities[19,20].

Vijayarekha *et al* evaluated the antibacterial activity of petroleum ether, chloroform, acetone, methanol and ethanol extract of the plant using the standard disc diffusion method against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*. The petroleum ether extract of the plant showed a maximum zone of inhibition in *Escherichia coli* of 28mm, *Klebsiella pneumoniae* of 21mm and *Pseudomonas aeruginosa* of 20mm. It revealed that the petroleum ether extract was found to be more effective than the chloroform, ethanol, acetone, methanol extracts. Madhavi A *et al* performed the antimicrobial studies of extracts of petroleum ether, benzene, chloroform, ethanol and water of *Acalypha indica* L. against gram-positive bacteria such as *Staphylococcus aureus*, *Streptococcus Spp*., *Bacillus subtilis*, and gram-negative bacteria such as *Escherichia coli*, *Shigella dysenteriae*, *Salmonella typhi* and *Pseudomonas aeruginosa*. The ethanolic extract shows strong antibacterial activity against *Staphylococcus aureus, Shigella dysenteriae* and *Pseudomonas aeruginosa* ant the extract shows positive response against *Bacillus subtilis, Streptococcus sp*. and *Escherichia coli*. The ethanolic extract demonstrated strong antibacterial activity compared to other extracts[21,22].

PLANT PROFILE: 6

Botanical name	*Glycyrrhiza glabra*
Kingdom	Plantae
Division	Angiosperms
Class	Dicotyledons
Order	Rosales
Family	Leguminosae
Genus	Glycyrrhiza
Species	*Glycyrrhiza glabra*
Habitat	Americas, Asia, Europe, Australia

Figure No: 6 *Glycyrrhiza glabra*

Glycyrrhiza glabra (Figure-6) is a perennial shrub, attaining a height upto 2.5 m. The leaves are compound, imparipinnate, alternate, having 4-7 pairs of oblong, elliptical or lanceolate leaflets. The flowers are narrow, typically papilionaceous, borne in axillary spikes, lavenderto violet in color. The calyx is short, campanulate, with lanceolate tips and bearing glandular hairs. The fruit is a compressed legume or pod, up to 1.5 cm long, erect, glabrous, somewhat reticulately pitted, and usually contains 3- 5 brown, reniform seeds. The roots contain glycyrrhizin, which is a saponin that is 60 times sweeter than cane sugar; comprised of a triterpenoid aglycone, glycyrrhetic acid conjugated to a disaccharide of glucuronic acid. Flavonoid-rich fractions include liquirtin, isoliquertin liquiritigenin and rhamnoliquirilin. The presence of many volatile components such as pentanol, hexanol, linalool oxide A and B, tetramethyl pyrazine, terpinen-4-o, geraniol. Liquorice used for Eczema, Herpes and Shingles. It decreases serum testosteronelevels in women and is beneficial in aplastic anemia. It is reported to possess various pharmacological properties such as anti-tussive, expectorant, anti-bacterial, hepatoprotective, antioxidant, anticoagulant, anti-ulcer, anti-viral, anti-tumor, immune- modulator, anti-diabetic activities [23,24].

Karahana F *et al* investigated the antimicrobial activities of methanolic extracts of root of *Glycyrrhiza glabra* var. glandulifera. The plant extracts were evaluated against nine bacterial strains and two yeast strains using disc diffusion and minimum inhibitory concentration methods. The bacterial strains include six Gram-positive bacteria such as *Staphylococcus aureus, Enterococcus faecalis, Micrococcus luteus, Bacillus cereus, Enterococcus, Staphylococcus aureus*, and three Gram-negative bacteria such as *Escherichia coli, Pseudomonas aeruginosa, and Klebsiella pneumoniae*. The yeast species include *Candida krusei* and *Candida parapsilosis*. The study indicated that root extracts of the plant were found to be more effective against Candida species than against bacterial strains. It has also been reported that root extracts showed higher antimicrobial activity against Gram-positive bacteria than against Gram-negative bacteria. Nitalikar *et al* determined the antibacterial activities of various extracts such as ether, chloroform, acetone of roots of licorice against two gram positive strains namely *Bacillus subtilis* and *Staphylococcus aureus*, and two gram-negative strains namely *Escherichia coli* and *Pseudomonas aeruginosa* using the agar well diffusion method. Among all, acetone extracts have shown significant antibacterial activities towards tested various bacterial strains[25,26].

PLANT PROFILE: 7

Botanical name	*Andrographis paniculata*
Kingdom	Plantae
Division	Angiosperms
Class	Dicotlydons
Order	Personales
Family	*Acanthaceae*
Genus	Andrographis
Species	*Andrographis paniculata*
Habitat	Southern and Southeastern Asia

Figure No: 7 *Andrographis paniculata*

Andrographis paniculata (Figure-7) is an annual, branched, herbaceous plant erecting to a height of 30-110 cm; Leaves are simple, opposite, lanceolate, glabrous, 2–12cm long, 1–3cm wide with margin acute and entire or slightly undulated. Inflorescence of the plant is characterized as patent, terminal and axillary in panicle, 10–30 mm long; bract small; pedicel short. The flowers possess botanical features of calyx 5-particle, small, linear; corolla tube narrow, about 6 mm long. Seeds are very small and subquadrate. The most important metabolites are terpenoids, and the other compound includes flavonoids xanthones, polyphenols, macro and trace elements. The diterpenoid lactones are the most common terpenoid Compounds; Andrographolide is most prominent in occurrence and quantity. It is a medicinal plant traditionally used for the treatment of cold, fever, laryngitis and several infectious diseases ranging from malaria to dysentery and diarrhoea. It is reported to have various pharmacological activities such as, anti-microbial, anti-inflammatory, anti-oxidant,

immunomodulatory, cytotoxicity, anti-diabetic, insecticidal, liver enzyme modulation, hepatorenal protective, sex hormone modulation, neuroprotective, antipyretic activities [27,28].

Geetha *et al* studied the antibacterial activity of chloroform, and methanol extracts of *Andrographis paniculata* against *Escherichia coli*, *Aeromonas hydrophila*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus subtilis*, *Klebsiella pneumonia* and *Salmonella typhi* by agar well diffusion method. The study revealed that all the doses of both chloroform and methanol extracts of *Andrographis paniculata* inhibited the growth of all the tested microorganisms except *Pseudomonas aeruginosa*. Ali S *et al* evaluated the **c**old and hot methanolic extract of leaves and whole plant parts of *Andrographis paniculata* against gram-negative such as *Escherichia coli*, *Klebsiella pneumonia*, *Streptococcus pyogenes*, *Salmonella typhimurium* and gram-positive such as *Staphylococcus aureus*. Among all the bacterial pathogens tested, maximum activity and highest zone of inhibition (22 mm) were observed against *Escherichia coli* at a dose of 3.0 mg[29,30].

PLANT PROFILE: 8

Botanical name	*Calotropis procera*
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	gentianales
Family	A*sclepiadaceae*
Genus	Calotropis
Species	*Calotropis procera*
Habitat	Asia, America, Africa

Figure No: 8 *Calotropis procera*

Calotropis procera (Figure-8) can achieve a height of 2.5-6m, grey-green leaves, and have a waxy appearance, derived from the name procera. They are 15-30 cm long and 2.5-10 cm broad. The flower petals are arranged in pentamerous form, small, cream or greenish white at base, and purple violet at the extremity of the lobes. It has a deep root system and contain fleshy fruits. It is pollinated by two carpenters' bees. The plant leaves have secondary metabolites such as phenols, flavonoids, terpenoids, sugars, alkaloids, tannins, cardenolides, glycoside, saponins and steroids including bitter contents such as calotropin, calotoxin, calactin, and uscharin also produces volatile organic compounds. It is a mixture of biologically active compounds including calotropin, calotoxin, caoutchouc, uscharin, trypsin, calactin, voruscharin, syriogenin, uzarigenin, and proceroside. It is reported to possess various pharmacological properties such as analgesic, antinociceptive, anticonvulsant, antimalarial, anthelmintic, myocardial infarction, schizontocidal, cytotoxic, larvicidal, wound healing, antifertility, estrogenic functionality, dermatophytic activities [31,32,33].

Kumar *et al* screened the aqueous extract of the leaves of *Calotropis gigantea* for the *In-Vitro* antimicrobial activity against clinical isolates of bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Bacillus cereus*, *Pseudomonas aeruginosa*, *Micrococcus luteus* and *Klebsiella pneumoniae* by well diffusion method. The extract showed significant effect on the tested organisms. The extract showed a maximum zone of inhibition against *Escherichia coli* of 17.6 mm. and the lowest inhibition of 12.6mm observed against *Klebsiella pneumoniae*. The crude extract showed the maximum relative percentage inhibition of 188.52% against *Bacillus cereus* and the lowest relative percentage inhibition of 24.92% against *Micrococcus luteus*. Minimum Inhibitory Concentration measured by modified agar well diffusion method. Sharma *et al* evaluated *in vitro* antibacterial potential of the ethanolic extract of *Calotropis gigentica* against *Streptococcus mutans* and *Lactobacilli casei* by using the disc diffusion method. At 1.25% concentration, the maximum inhibition zone of inhibition of 16mm and 14mm observed against the tested pathogens, *Streptococcus mutans* and *Lactobacilli casei*[34,35].

PLANT PROFILE: 9

Botanical name	*Justicia adathodai*
Kingdom	Plantae
Division	Tracheophyta
Class	Magnoliopsida
Order	Lamiales
Family	*Acanthaceae*
Genus	Justicia
Species	*Justicia adathodai*
Habitat	Tropical and Subtropical regions

Figure No: 9 *Justicia adathodai*

Justicia adathodai (Figure-9) is an evergreen, perennial shrub commonly 1–2.5 m high. The leaves are lanceolate, opposite, 10–15 cm long and 4 cm wide, and known as Malabar nut tree. The flowers are white, pink or purple. The plant grows throughout theIndian peninsula in wastelands in a variety of habitats and soil up to an altitude of 1350 m. The phytochemical analysis of *Justicia adathoda* leaves shows the presence of various phenols, tannins, alkaloids, anthraquinone, saponins, flavonoids and reducing sugars. The pharmacologically most studied clinical component of the plant is a bitter quinazoline alkaloid vaccine, which is always present in leaves, roots and stem. The plant interferes in the treatment of Dengue through the prevention of chemotaxis and release of cytokines and chemokines thereby preventing the vascular leakage, which is a major threat to the mortality of dengue hemorrhagic fever. Additionally, It is used as a folklore medicine to speed delivery during childbirth. It is reported to show various pharmacological properties such as anti-pyretic, anti-

viral, immunomodulatory, antioxidant, anti-inflammatory, antitussive, anti-TB, thrombolytic, anti-bacterial, anti-fungal, anti-microbial, hepatoprotective activities [36,37].

Gohel A *et al* evaluated the antibacterial and antifungal activities of ethanolic leaf extracts of *Adhatoda vasica* against bacterial strains such as *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus Pyogenes*, *Pseudomonas aeruginosa* and fungal strains such as *Candida albicans, Aspergillus Niger, Aspergillus clavatus*. The result suggested that the largest zone of inhibition was found to be against *Pseudomonas aeruginosa* and *Aspergillus clavatus*. Muruganantham *et al* Screened the In-vitro antimicrobial activity of ethyl acetate fraction of *Adhatoda vasica* flowers extract against four bacterial strains *Salmonella typhi, Escherichia coli, Enterococcus faecalis, Bacillus cereus* and two fungal strains such as *Curvularia lunata* and *Candida albicans* by using disc diffusion method. The result concluded that *Adhatoda vasica* shows better antibacterial and antifungal activity against all the tested microorganisms[38,39].

PLANT PROFILE: 10

Botanical name	*Plectranthus amboinicus*
Kingdom	Plantae
Division	Angiosperms
Class	Magnoliopsida
Order	Lamiales
Family	*Lamiaceae*
Genus	Plectranthus
Species	*Plectranthus amboinicus*
Habitat	Tropical and Subtropical regions

Figure No: 10 *Plectranthus amboinicus*

Plectranthus amboinicus (Figure-10) are perennial herb aged 3–10 years old and highly

fragrant. This plant can climb, or progress, and can reach about 1-m height, and The leaves are thick, simple, and light blade, a fat green opposite arrangement of leaves (2.5–3 cm long). Flowers have a bell-shaped calyx and the throat is smooth inside with two lips, the upper lip being ovate and thin, the lower lip having four narrow teeth. The corolla is pale purplish and five times longer than the calyx, with a short tube, inflated throat, and short lips. The essential oil of the plant contains high amounts of bioactive compounds, mainly monoterpenoids such as carvacrol, thymol, γ-terpinene, α-terpineol, and p-cymene. The chemical constituents are Butylaniside, -caryophyllene, carvacrol, 1-8-cineole, p-cymene, ethylsalicylate, eugenol, Butylaniside, -caryophyllene, carvacrol, 1-8-cineole, p-cymene, ethylsalicylate, eugenol. This golden herb is very effective in folkloric medicines. This plant is effective in wound healing with very less side effects. It is reported to possess various pharmacological actions such as anti-microbial, anti-bacterial, anti-inflammatory, anti-fungal, skin acre, anti-diabetic, wound healing effect, diuretic, analgesic, antibiofilm efficacy, antiurolithiatic activities [40,41].

Ismayil *et al* determined the antibacterial activity of hydroalcoholic extracts of leaves of Plectranthus amboinicus on two Gram-negative bacterial strains such as Klebsiella pneumoniae and Shigella flexneri using the agar well diffusion method. The study revealed that the extract showed a zone of inhibition on the growth of both the tested bacteria, *Klebsiella pneumoniae and Shigella flexneri,* and confirmed the antimicrobial activity. Sindhu MS *et al* evaluated the antimicrobial activity of various extracts such as petroleum ether, methanol and water of leaves of *Plectranthus amboinicus.* The activity was carried out against the bacterial strains such as *Escherichia coli, Staphylococcus aureus* and fungal strains such as *Aspergillus niger, Candida albicans* using agar well diffusion method. The study reported that the methanolic extract of the plant showed higher antimicrobial activity towards the tested microorganisms when compared with aqueous and petroleum ether extracts[42,43].

CONCLUSION:

Plants, herbs, and ethnobotanicals have been used since the early days of humankind and are still used throughout the world for health promotion and treatment of disease. Plants and natural sources form the basis of today's modern medicine and contribute largely to the commercial drug preparations manufactured today. About 25% of drugs prescribed worldwide derived from plants. Still, herbs, rather than drugs, are often used in health care. For some, herbal medicine is the preferred method of treatment. For others, herbs used as an

adjunct therapy to conventional pharmaceuticals [44]. However, in many developing societies, traditional medicine of which herbal medicine is a core part, and is the only system of health care available or affordable. Regardless of the reason, those using herbal medicines are assured that the products they are buying are safe, and contain what they are supposed to, whether this is a particular herb or a particular amount of a specific herbal component. Consumers should also be given science-based information on dosage, contraindications, and efficacy. To achieve this, global harmonization of legislation is needed to guide the responsible production and marketing of herbal medicines. If sufficient scientific evidence of benefit is available for an herb, then such legislation should be allowed to be used appropriately to promote the use of that herb so that these benefits can be realized for the promotion of public health and the treatment of disease.

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