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Wild Medicinal Plants: Natural Source of Therapeutic & Antimicrobial Agents

Deepa R. Hebbar¹, Nataraj K¹, F.T.Z. Jabeen², NS Suresha¹, GL Basavaraj¹, Prithviraj HS¹, Manjula S^{3*}

¹Department of Botany, Maharani's Science College for Women, Mysore, Karnataka, India

²Department of Botany, Government first grade college of Arts, Science and Commerce, Sira, Karnataka, India

³Department of Botany, Government First Grade College, Ramanagara, Karnataka, India

*Corresponding author: Manjula S

*Email-Id: manjularaj1983@gmail.com

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Abstract

Forty-five wild medicinal plants from 19 different families are given and collected in present study from Roopanagar in Dasankoppal village, Mysore. Finding and cataloging the wild medicinal plants that are present in the research region was the primary goal of the current investigation. To highlight their significance, the pharmacological and medical values are provided.

Keywords: Medicinal plants, Mysore, Medicinal uses, Pharmacological values

Introduction

Survey of medicinal plants plays a vital role in the drug research programme of the Indian systems of medicine. India, where plants have been used as a source of traditional medicine, since time immemorial has become an integral part of our culture. The biodiversity of India is well known, with a wide variety of habitats, a high level of endemism, and one of the eight mega-diverse hotspots in the world [1]. There are an estimated of 300,000-500,000 flora species on earth, of which 50,000-80,000 flowering plant species are used for medicinal purposes worldwide [2]. The World Health Organization (WHO) estimates that approximately 80% of the population worldwide relies on herbal medicine for medical needs, particularly in rural areas [3]. Due to the lack of modern healthcare facilities in developing countries, particularly India, traditional medicines offer an affordable method of primary healthcare. In general, it is estimated that 6,000 species are employed in traditional and herbal medicine in India, which corresponds to around 75% of the demands of the third world of which 23% of indigenous plants were estimated to be present in India. In the meantime, 3,000 plants were formally recognized for their therapeutic qualities [4].

Study areas

Mysore is the third largest city in the state of Karnataka, India, which is located at 12.30°N 74.65°E and has an average altitude of 770 meters. It is spread across an area of 128.42 km² at the base of the Chamundi Hills in the southern region of Karnataka. Mysore has a tropical savanna climate. Mysuru district is the third richest in forest wealth in the State. The forest belt in the district begins from the western part of Hunsur taluk, spreads along the border of Kerala and Tamil Nadu into the

south and east. The thickest and richest forest areas are in H D Kote. The principal species of trees in the forests are teak, honne, rosewood, dindiga, eucalyptus and sandalwood. The soil of the district can be broadly classified as the laterite, red loam, sandy loam, red clay and black. Mysore area flora is quite rich and diverse with 1601 species of flowering plants belonging to 170 families and 778 genera [5]. The present study area, Roopanagar, in Dasankoppal village which is 1.4 mile located near Mysore with a Latitude 12.29911° or 12° 17' 57" north and Longitude 76.58374° or 76° 35' 2" east [6] is near 75 acre with a rich diversity of wild plants. The main objective of this survey was to identify and document the wild medicinal plants present in this locality.

Results and discussion

In the present study, 45 wild medicinal plants belonging to 19 families are identified (Plate 1). *Martynia annua* L. is a well-known small herbaceous annual plant in Ayurveda as kakanasika, which is being used in Indian traditional medicines for epilepsy, inflammation, and tuberculosis. This weed has been known to possess anthelmintic, analgesic, antipyretic, antibacterial, anti-convulsant, antifertility, antinociceptive, antioxidant, CNS depressant and wound healing activity. A wide range of chemical compounds including oleic acid, arachidic acid, linoleic acid, palmitic acid, gentisic acid, stearic acid, pelargonidin-3,5-diglucoside, cyanidin-3-galactoside, p-hydroxy benzoic acid, apigenin, apigenin-7-oglucuronide have been isolated from this plant [7]. The main pharmacological activities of *Jatropha gossypifolia* include anti-inflammatory, antineoplastic, antimicrobial, antioxidant, and anticholinesterase, and antihypertensive activities. Species of *Jatropha* are notably known for their toxic potential, and their toxicity is primarily related to the latex and seed contents. However, the potential mechanisms of these pharmacological activities have not been fully explored [8]. *Solanum nigrum* is an important plant in traditional medicines belongs to the family of solanaceae. It is used in hepatitis, fever, dysentery, and stomach complaint. The juice of the plant used on ulcers and other skin diseases. The fruits are used as a laxative, appetite stimulant, and for treating asthma and "excessive thirst". Traditionally the plant was used to treat tuberculosis. It is known as peddakasha pandla koora in the Telangana region. This plant's leaves are used to treat mouth ulcers that happen during winter periods. It is known as manathakkali keera in Tamil Nadu and kage soppu in Karnataka, and apart from its use as a home remedy for mouth ulcers, is used in cooking like spinach. The boiled extracts of leaves and berries are also used to alleviate liver-related ailments, including jaundice. The juice from its roots is used against asthma and whooping cough. *S. nigrum* is a widely used plant in oriental medicine where it is antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic activity. Chinese experiments confirm that the plant inhibits growth of cervical carcinoma [9]. *Mirabilis jalapa* L. which is traditionally used as Purgative and emetic, for treatment of many gastrointestinal disorders, including dysentery, diarrhea, muscle pain and abdominal colic. Besides this it also exhibits certain useful activities like Antiviral activity, antimicrobial activity, Antimalarial activity, Anthelmintic activity, Antioxidant activity, Aytotoxic activity Anti-tubercular drugs induced hepatotoxicity, Antinociceptive activity, Antifungal activity, Anti-corrosion activity, Antispasmodic activity, Antiinflammatory activity and many others. Pharmacologically active compounds include active alcoholic extract, ether compound-3,3'-Methylenebis (4- hydroxycoumarin) N-D-alpha-Phenylylglycinelaminaribiitol-3-(4-(dimethylamino) cinnamoyl) 4hydroxycoumarin [10]. *Cassia occidentalis* L. is an important member of plant family Fabaceae. *C. occidentalis* is known as 'kasamarda' and it has been mentioned in various nighandus viz. Rajnighantu, Dhanwantari, Bhavaprakasa, Rajballaba. It has active ingredients such as anthraquinones derivatives and their glycosides. *C. occidentalis* extract is used to cure eye inflammations in Ayurveda. It is also used in

Jamaican folk medicines for curing diarrhoea, dysentery, constipation, fever, cancer, eczema and venereal diseases. Seeds of *C. occidentalis* are good source of alternative plant proteins, rich in vitamin B3 and also abundant in Ca, K, P, Na, Mg, Fe, Zn, Cu but low in Mo, Co, Se, S and F. The amino acid profile revealed a high concentration of leucine, histidine, proline and glycine. It is a main ingredient of Liv. 52. Herbolax, a polyherbal formulation that is commonly used in treating constipation. A new indigenous metabolic corrective for newborns and infants called 'Bonnisan' is also made up of *C. occidentalis* (0.5 mg/5 ml), which helps to bring immediate relief from discomfort caused by gastric wind. Pharmacological investigations have revealed several biological activities such as antioxidant, analgesic, antipyretic, anti-inflammatory, hepatoprotective, anti-malarial, anti-diabetic, anti-cancer, and antidepressant activities of *C. occidentalis*. Detoxification of the seeds is essential through processing before its use in human/animal diet [11]. *Phyllanthus niruri* L. is a well-known medicinal plant that has been used both traditionally as well as scientifically as a traditional medicine for a variety of diseases all over the world due to its long-standing ethno medical records in Ayurveda, Chinese, and Malay. *Phyllanthus niruri* L. contains potent bioactive compounds having vital biological properties. As a result, incorporating such an essential plant into herbal medication formulations may improve treatment effectiveness of various diseases. Antimicrobial metabolites. *P. niruri* is an abundant natural resource available in many countries, and it can reduce health-care costs associated with conventional drugs, which are often inaccessible to the majority of the population for long-term treatment. Furthermore, clinical trial studies would benefit from further cheminformatics, toxicological, and mechanistic research. The scientific evidence of *phyllanthus niruri* L. has paved the way for more pharmacological research and creation of effective medicines for the treatment of a variety of communicable diseases [12]. *Mimosa* belongs to the taxonomic group Magnoliopsida and family Mimosaceae. In Latin it is called as *Mimosa pudica* Linn. Ayurveda has declared that its root is bitter, acrid, cooling, vulnerary, alexipharmic. It is used in the treatment of leprosy, dysentery, vaginal and uterine complaints, and inflammations, burning sensation, asthma, leucoderma, fatigue and blood diseases. Decoction of root is used as gargle to reduce toothache. It is very useful in diarrhea (athisaara), amoebic dysentery (raktaatisaara), bleeding piles and urinary infections [13]. *Caesalpinia pulcherrima* is an ornamental medicinal plant which are widely distributed throughout India. The plant is a perennial shrub having varying medicinal properties, which are widely used for the treatment of inflammation, ulcers, fevers, tumors etc. They also have abortifacient property and are widely used in malarial fever and the leaves act as an antimicrobial agent. The present study was a review on the various medicinal properties of the plant and the studies supporting their significance in the treatment of chronic diseases in herbal medicine industry. The phytochemical screening of the plant clearly showed the presence of alkaloids, glycosides, phenolics, tannins and flavanoids. Lot of researches were done on each part of the plant and there is a need of studying the compound by isolating single compound and to further study its properties. Various works on the antimicrobial, analgesic and anti-inflammatory activity were carried out by different researchers since the constituents in the plant favour these activities. Cytotoxic activities were studied on the wood and bark of the plant and good results were obtained. Isolation works on the plant parts were also carried out by different researchers and of these glycosides isolated from the wood and cassane like diterpenoid isolation were prominent work on the plant glycosides [14]. Genus *Thunbergia* belongs to the Acanthaceae family. More than 100 species of *Thunbergia* has been included in this genus. Antibacterial, antifungal and anthelmintic activity of *Thunbergia grandiflora*, anti-inflammatory, antitumor, antioxidant antinociceptive activity of *Thunbergia laurifolia* due to presence of rosmarinic acid and also antidiabetic and hepatoprotective activity of *Thunbergia laurifolia* has been reported [15].

In ethnomedicine, *Mitracarpus* species offer a wide range of applications, such as in the treatment of toothache, headache, dyspepsia, amenorrhea, venereal diseases, liver diseases, leprosy, wounds, burns, cuts, boils, eczema, mycosis, scabies, sore throat, respiratory diseases, hepatitis, jaundice, rashes, ringworm, inflammation, diabetes, and lice. Bioactive secondary metabolites such as psychorubrin, ursolic acid, rutin, kaempferol-3-O-rutinoside, kaempferol, stigmasterol, and quercetin among others, were detected in the various extracts. These bioactive compounds and extracts exhibited diverse pharmacological activities, including antioxidant, anti-inflammatory, anticancer, antifungal, anti-diabetic, antibacterial, antileishmanial, schistosomicidal, and anti-diarrheal. Although, only a few members of this genus have been studied, the vast medicinal uses of the plants reported so far cannot be overemphasized [16]. A medicinal plant *Tridax Procumbens* commonly known as coat button or kansari (Hindi) or Ghamara belonging to family Asteraceae. It is a plant used majorly in Indian traditional medicine and also use by different communities. It is a very promising species that produces secondary metabolites such as alkaloid, steroids, carotenoid, flavonoid (catechins, centaurein and bergenins), fatty acid, phytosterols, tannins and minerals reported to have a variety of medicinal uses including antioxidant, antibacterial, anti-inflammatory, antimicrobial, vasorelaxant, antileishmanial, antianemic, immunomodulatory, hepatoprotective and mosquitocidal activities which have been scientifically screened. Still there is shortage in the studies on isolation, characterization, and evaluation of active principle from the extract [17]. *Anisomeles malabarica* (L.) R. Br. is perhaps the most useful traditional medicinal plant. It is a highly aromatic plant belonging to the family Lamiaceae (Labiatae). *Anisomeles malabarica* is a species of herbaceous plant native to tropical and subtropical regions. Mosquitoes act as a vector for most of the life-threatening diseases like malaria, yellow fever, dengue fever, filariasis, encephalitis. The extract was assayed for their toxicity against the important vector mosquitoes *Anopheles stephensi*. The plant extract showed larvicidal effects after 24 h of exposure; however, the highest larval and pupal mortality was found in the methanol extract of *Anisomeles malabarica* against the first to fourth instars larvae and pupae. This result suggested that the plant extract have the potential to be used as an ideal eco-friendly approach for the control of mosquito vector. Different aspects of *Anisomeles malabarica* medicinal values are briefly demonstrated, such as potential anti-allergic, anti-anaphylactic, anti-bacterial, anticancer, anti-carcinogenic, anti-inflammatory, antiepileptic potential, antifertility, anti-pyretic activity, and antispasmodic [18]. *Asystasia gangetica*, also known as 'Chinese violet' or 'Ganges primrose' is an ornamental, scattering, groundcover herb. The plant is about 0.30 to 0.60 m in height, mainly distributed in sub-Saharan tropical Africa, Arabia, and tropical Asia (including India). Ethnobotanically, the decoction of its leaves is effective in the treatment of rheumatism, stomachache, anthelmintic, heart pains, asthma, astringent, diaphoretic, woman infertility, etc. It is mainly reported to contain chalcone, biflavons, glucoside, amino acid, iridoid glycoside, etc. Pharmacologically plant is reported to possess anti-asthmatic, antihypertensive, anti-diabetic, anti-hyperlipidaemic, anti-microbial, anti-oxidant activity, anti-snake venom, etc. [19]. *Trichodesma indicum* commonly known as Adhapushpi and belongs to the family Boraginaceae. Traditionally it was a useful medicinal plant to cure various ailments like Arthritis, fever, skin disease, arthralgia, and dysentery. Each part of the plant is useful and was reported for its antioxidant, anti-inflammatory, analgesic, antipyretic, antimicrobial and antidiabetic activity [20]. In Europe, it is used as a trap crop for management of the potato cyst nematode (PCN). Its berries are edible, but little is known about their nutritional content. If more was known about their nutritional value this could provide incentive to grow it as a food crop. Phytonutrient content was characterized in berries from four varieties and four synthetic breeding lines developed to have reduced spininess. Litchi tomatoes contained 6.8–10.4 mg of total phenolics per g dry weight.

Antioxidants measured by FRAP ranged from 148 to 242 $\mu\text{mol TE/g DW}$. HPLC analysis showed chlorogenic acid (1856–4385 $\mu\text{g/g DW}$) was the most abundant phenylpropanoid. Ascorbic acid ranged from 2042 to 4511 $\mu\text{g/g DW}$. The yellow/orange flesh color was due to carotenoids, with β -carotene the most abundant (204–633 $\mu\text{g/g DW}$). Soluble protein in Litchi tomato ranged from 86.9 to 120.9 mg/g. Of the cultivated Litchi tomato varieties analyzed, SS91 had the highest amount of antioxidant activity, ascorbic acid, chlorogenic acid and β -carotene. These results suggest that Litchi tomato fruits can be a good source of phytonutrients, expanding the plant's functionality beyond its use as a PCN trap crop [21]. *Croton sparsiflorus* is used traditionally in treatment for cuts, ulcer, fever, inflammation, hypertension, analgesic and as antivenom [22]. *Digera muricata* (L.) Mart. is an annual herb, growing to 20–70 cm tall. It is an important medicinal herb belongs to the Amaranthaceae family, found as a weed throughout India. Though almost all of its parts are used in traditional systems of medicines, leaves, roots and shoots are the most important parts which are used medicinally. The present article gives an account of updated information on its phytochemical and pharmacological properties. The review reveals that wide numbers of phytochemical constituents have been isolated from the plant which possesses activities like antibacterial, antifungal, diuretic, laxative, Free radical scavenging activity, anthelmintic, and various other important medicinal properties. The crushed plant is used as mild astringent in bowel complaints. The Leaves and spikes are used as a vegetable. Flowers and seeds used in the treatment of urinary discharges. For the last few decades or so, extensive research work has been done to prove its biological activities and pharmacology of its extracts. Analysis of various fractions of the *D muricata* indicated the presence of flavonoids, alkaloids, terpenoids, saponins, coumarins, tannins, cardiac glycosides and anthraquinones [23]. The genus *Stachytarpheta* Vahl (Verbenaceae), known as "porter weed" [English], "gervao," includes many species widely distributed in tropical and subtropical America and Africa with few members in tropical Asia and Oceania. It is valued traditionally for its different species that possess anticancer, anti-inflammatory, antidiabetic, antimicrobial, and antipyretic activities. Interestingly, current research on genus has revealed the presence of phenylethanoid with various pharmacological properties and multispectrum therapeutic applications. A relatively large number of studies cited here have adduced the possible areas where the important species of this genus can exhibit their therapeutic activities in the treatment of chronic ailments or diseases including ulcers, fever, renal disorders, and atherosclerosis [24].

Calotropis procera, belonging to the Asclepidaceae family, is present throughout India and in other warm, dry places such as, Warizistan, Afghanistan, Egypt, and tropical Africa. Its common names are Akra, Akanal, and Madar. The leaves of *Calotropis procera* are said to be valuable as an antidote for snake bite, sinus fistula, rheumatism, mumps, burn injuries, and body pain. The leaves of *Calotropis procera* are also used to treat jaundice. A study on *Calotropis procera* leaf samples extracted the air-dried leaf powder with different solvents such as petroleum-ether (60–80°C), benzene, chloroform, ethanol, and sterile water. Preliminary phytochemical analysis was done long with measurement of the leaf constants, fluorescence characteristics, and extractive values. Quantitative estimation of total ash value, acid insoluble ash, and water-soluble ash may serve as useful indices for identification of the powdered drug. Histochemical studies which reveal rows of cylindrical palisade cells and, vascular bundles may also serve as useful indices for identification of the tissues. These studies suggested that the observed pharmacognostic and physiochemical parameters are of great value in quality control and formulation development of *Calotropis procera* [25]. *Datura stramonium* (*D. stramonium*) is one of the widely well-known folklore medicinal herbs. The troublesome weed, *D. stramonium* is a plant with both poisonous and medicinal properties and has been proven to have great pharmacological potential with a great utility and usage in folklore

medicine. *D. stromonium* has been scientifically proven to contain alkaloids, tannins, carbohydrates, and proteins. This plant has contributed various pharmacological actions in the scientific field of Indian systems of medicines like analgesic and antiasthmatic activities [26].

Borreira and Spermacoce are genera of Rubiaceae widespread in tropical and subtropical America, Africa, Asia, and Europe. Based on its fruits morphology they are considered by many authors to be distinct genera and most others, however, prefer to combine the two taxa under the generic name Spermacoce. Whereas the discussion is still unclear, in this work they were considered as synonyms. Some species of these genera play an important role in traditional medicine in Africa, Asia, Europe, and South America. Some of these uses include the treatment of malaria, diarrheal and other digestive problems, skin diseases, fever, hemorrhage, urinary and respiratory infections, headache, inflammation of eye, and gums. To date, more than 60 compounds have been reported from Borreria and Spermacoce species including alkaloids, iridoids, flavonoids, terpenoids, and other compounds. Studies have confirmed that extracts from Borreria and Spermacoce species as well as their isolated compounds possess diverse biological activities, including anti-inflammatory, antitumor, antimicrobial, larvicidal, antioxidant, gastrointestinal, anti-ulcer, and hepatoprotective, with alkaloids and iridoids as the major active principles [27]. In folklore medicine, *Conocarpus lancifolius* is used to treat various illnesses. The main objective of this study was a comprehensive investigation of *Conocarpus lancifolius* leaf aqueous extract (CLAE) for its antioxidant, cardioprotective, anxiolytic, antidepressant, and memory-enhancing capabilities by using different in vitro, in vivo and in silico models [28]. In Ayurveda, all parts of *Evolvulus alsinoides* are used for therapeutic purposes. The medicinal potential of Ayurvedic herbs is vast, and there is a growing interest in exploring this potential. Plant-based medicine is gaining popularity due to the emergence of new techniques for chemical characterization and medical research. Since ancient times, plants have been valued for their ability to heal and relieve pain. Medicinal plants are often used for their healing properties. Many types of herbs are used in traditional folk medicine, and they have a long history of being effective in traditional remedies. In vitro screening methods are also important for identifying promising plant extracts with promising and useful properties for future chemical and medical analysis. *Evolvulus alsinoides* is a low-growing perennial herb with a slightly branching woody rootstock. It has square, hairy stems that are annual and up to 30 cm long. The branches are often prostrate. *Evolvulus alsinoides* has small, elliptic leaves that are acute, sensitive, and densely hairy. All parts of this plant are used in Ayurvedic medicine to treat cough, cold, and fever. It is also used to treat inflammation-related neurodegenerative disorders, such as Alzheimer's disease and Parkinson's disease. *Evolvulus Alsinoides* has been shown to have azoospermic, inotropic, and anti-inflammatory properties. It also has anti-hemorrhagic and antioxidant properties. This herb was used in ancient medicine as a brain tonic, and recent preclinical studies have shown that it is effective in treating neurological disorders such as bronchial asthma and memory loss. The most remarkable property of *Evolvulus Alsinoides* is its ability to enhance memory and intellect. It has been shown to improve cognitive function in both animals and humans. *Evolvulus Alsinoides* is a promising herb for the treatment of neurological disorders, and more research is needed to investigate its full potential [29]. *Lantana camara* also referred to as "Spanish flag or West Indian Lantana"; and sometimes known as "Red Sage." *L. camara* is an "ornamental weed" with aromatic leaves, prange, blue, red, yellow, and bright red flowers, and dark blue and black fruits (drupes). *L. camara* especially the leaves have been used as an anti-tumor, antibacterial, anti-hypertensive agent, tonic, and expectorant whereas the roots are known for the treatment of rheumatism, skin rashes, and malaria. The infusion method of extraction of the leaves and other parts are known for their anti-inflammatory properties and added to the bath as an anti-rheumatic agent. The decoction prepared

from *L. camara* leaves is mostly used in herbal medicine for wound healing, fever treatment, cough treatment, influenza treatment, stomach ache, malaria, etc. It has also been recorded that can be used for the treatment of cancers, chickenpox, measles rheumatism, and ulcer. *L. camara* also displays the following activities such as antioxidant, anti-fungal, anti-diabetic, analgesic, and anti-inflammatory [30]. *Spermacoce ocymoides* (Burm F). belongs to the family Rubiaceae, commonly known as "Purple Leaved Button Weed" (also known as "Basil like button weed") which is a vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have buds borne at or below the ground surface. It is found in Odisha and through out of India, also found in Cameroon, Congo, Gabon, Uganda etc as a wayside weed. The plant having several folklores and ethnomrdicinal claims which includes: the plant is active against hookworm, ringworm, some bacteria like *Streptococcus*, *E. coli*, *Proteus mirabilis* and so having wound healing properties, also the whole part uses in diarrhea and dysentery [4], leaves are used to treat eczema and skin problem etc. The literatures revealed that there is no and lack of scientific reports on pharmacognostical, pharmacological and phytochemical evaluation [31]. *Leucas aspera* (Willd.) Linn. (Family: *Lamiaceae*) commonly known as 'Thumbai' is distributed throughout India from the Himalayas down to Ceylon. The plant is used traditionally as an antipyretic and insecticide. Flowers are valued as stimulant, expectorant, aperient, diaphoretic, insecticide and emmenagogue. Leaves are considered useful in chronic rheumatism, psoriasis, and other chronic skin eruptions. Bruised leaves are applied locally in snake bites. Medicinally, it has been proven to possess various pharmacological activities like antifungal, antioxidant, antimicrobial, antinociceptive and cytotoxic activity. Further, studies reveal the presence of various phytochemical constituents mainly triterpenoids, oleanolic acid, ursolic acid and b-sitosterol, nicotine, sterols, glucoside, diterpenes, phenolic compounds (4-(24-hydroxy-1-oxo-5-n-propyltetracosanyl)-phenol). These studies reveal that *L. aspera* is a source of medicinally active compounds and have various pharmacological effects; hence, this drug encourage finding its new therapeutic uses [32]. *Centella asiatica* is an important medicinal herb that is widely used in the orient and is becoming popular in the West. Triterpenoid, saponins, the primary constituents of *Centella asiatica* are manly believed to be responsible for its wide therapeutic actions. Apart from wound healing, the herb is recommended for the treatment of various skin conditions such as leprosy, lupus, varicose ulcers, eczema, psoriasis, diarrhoea, fever, amenorrhea, diseases of the female genitourinary tract and for relieving anxiety and improving cognition. The present review attempts to provide comprehensive information on pharmacology, mechanisms of action, various preclinical and clinical studies, safety precautions and current research prospects of the herb. At the same time, studies to evaluate the likelihood of interactions with drugs and herbs on simultaneous use, which is imperative for optimal and safe utilization of the herb, are discussed. Plants have been used as treatments for thousands of years, based on experience and folk remedies and continue to draw wide attention for their role in the treatment of mild and chronic diseases. In recent times, focus on plant research has increased all over the world and a large body of evidence has been accumulated to highlight the immense potential of medicinal plants used in various traditional systems of medicine. Commonly known as *mandukparni* or Indian pennywort or *jalbrahmi*, it has been used as a medicine in the Ayurvedic tradition of India for thousands of years and listed in the historic '*Sushruta Samhita*', an ancient Indian medical text. The herb is also used by the people of Java and other Indonesian islands. In China, known as *gotu kola*, it is one of the reported "miracle elixirs of life" known over 2000 years ago [33].

Alternanthera sessilis commonly known as 'sessile joy weed' or 'dwarf copperleaf' is found throughout the hotter parts of India up to an altitude of 1200 m². In Assam, the plant has been

traditionally used in the treatment of jaundice along with other ailments. The study focuses primarily on the evaluation of hepatoprotective activity of the plant with special references to its putative protective role in carbon tetrachloride induced liver injury on Wister albino rat. The in vivo hepatoprotective activity of the methanolic extract at the dose of 250 mg/kg body weight was highly effective in controlling SGPT, SGOT, ALP, serum cholesterol and serum bilirubin level as compared to silymarin. The said extract also significantly lowered the lipid profile caused by CCl₄. The activity shown by methanolic extract of the whole plant of *A. sessilis* is of considered importance and thus justified its use in controlling hepatic diseases in traditional treatment system. The plant is commonly known as 'sessile joyweed' or 'dwarf copperleaf'. This is a perennial herb often found in and near ponds, canals, and reservoirs. In Assam, this plant is commonly known as 'Matikanduri'. *Alternanthera sessilis* possibly originates from tropical America but is now widespread in the tropics and subtropics of the world including the whole of tropical Africa. It is a weed in tropical lands and can grow in all soil types. Shoots and leaves are often eaten as vegetable. Depending on location, many other common names exist: A decoction of *A. sessilis* is recommended as an herbal remedy to treat wounds, flatulence, nausea, vomiting, cough, bronchitis, diarrhea, dysentery and diabetes. Its root can relieve inflamed wounds. It is used as a local medicine often in mixtures with other medicinal plants, to treat hepatitis, tight chest, bronchitis, asthma and other lung troubles. The leaves and shoots boiled and drunk as antihypertensive remedy [34]. *Commelina diffusa* is widely known as the climbing dayflower or spreading dayflower, which is an annual herb belonging to the family Commelinaceae that has been used as a medicinal plant for centuries. This plant distributes dispersedly with heavy branches and slowly grows along the soil. The plant can be found in the tropical and subtropical locations worldwide. *Commelina diffusa* has been used for many years to heal swelling, treatment of urinary tract infection and respiratory tract infections, diarrhea, enteritis, and hemorrhoids. The plant has also been used in fever, malaria, insect, bug bites, rheumatoid arthritis, gonorrhea, influenza, and bladder infection, etc. There are some experiments that have been conducted to observe the pharmacological properties of this plant [35]. *Cyanotis axillaris* is an herbal weed belongs to the family of Commelinaceae. Traditionally *C. axillaris* is used to treat tympanitis, ascites, abscesses, fever, worms and ear drum infection. There is no data for its antifungal activity in traditional use. Moreover, there is no scientific evidence for its antifungal activity. Since Products from plants are safe, easily available, less expensive, efficient over the synthetic drugs used in the market and having less side effect, we chose *C. axillaris* to examine its antifungal activity to explore new antifungal bioactive principle to overcome the existing old antifungal drugs to treat opportunistic fungal diseases [36]. *Justicia tranquebariensis* is a small shrub, which is widely distributed in southern parts of India. In this genus about 20 species have been chemically investigated and major secondary metabolites isolated were ligans, flavonoids, steroids, and tri terpenes. The juice of small and somewhat fleshy leaves of genus *justicia* is considered by natives of india as cooling and aperients, and is prescribed for the children in the smallpox. Some species of the genus *justicia* have been used in the traditional system of medicines for the treatment of fever, pain, inflammation, diabetes, diarrhoea and liver diseases. They also possess anti- inflammatory, anti-allergic, anti-tumoral, anti-viral and analgesic activities. The leaf juice *justicia tranquebariensis* has been used to treat jaundice and leaf paste is applied over affected area to treat skin diseases [37]. *Ruellia* is a genus of flowering plants commonly known as Ruellias or Wild Petunias which belongs to the family Acanthaceae. It contains about 250 genera and 2500 species. Most of these are shrubs, or twining vines; some are epiphytes. Only a few species are distributed in temperate regions. They are distributed in Indonesia and Malaysia, Africa, Brazil, Central America and Pakistan. Some of these are used as medicinal plants. Many species of the genus

has antinociceptive, antioxidant, analgesic, antispasmodic, antiulcer, antidiabetic and anti-inflammatory properties. The phytochemicals constituents: glycosides, alkaloids, flavonoids and triterpenoids are present. The genus has been traditionally claimed to be used for the treatment of flu, asthma, fever, bronchitis, high blood pressure, eczema, and diabetes [38]. Tulsi is an aromatic shrub in the basil family Lamiaceae (tribe ocimeae) that is thought to have originated in north central India and now grows native throughout the eastern world tropics. Within Ayurveda, tulsi is known as "The Incomparable One," "Mother Medicine of Nature" and "The Queen of Herbs," and is revered as an "elixir of life" that is without equal for both its medicinal and spiritual properties. Within India, tulsi has been adopted into spiritual rituals and lifestyle practices that provide a vast array of health benefits that are just beginning to be confirmed by modern science. This emerging science on tulsi, which reinforces ancient Ayurvedic wisdom, suggests that tulsi is a tonic for the body, mind and spirit that offers solutions to many modern-day health problems. Tulsi is perhaps one of the best examples of Ayurveda's holistic lifestyle approach to health. Tulsi tastes hot and bitter and is said to penetrate the deep tissues, dry tissue secretions and normalize kapha and vata. Daily consumption of tulsi is said to prevent disease, promote general health, wellbeing and longevity and assist in dealing with the stresses of daily life. Tulsi is also credited with giving luster to the complexion, sweetness to the voice and fostering beauty, intelligence, stamina, and a calm emotional disposition. In addition to these health-promoting properties, tulsi is recommended as a treatment for a range of conditions including anxiety, cough, asthma, diarrhea, fever, dysentery, arthritis, eye diseases, otalgia, indigestion, hiccups, vomiting, gastric, cardiac, and genitourinary disorders, back pain, skin diseases, ringworm, insect, snake and scorpion bites and malaria. Considered as a potent adaptogen, tulsi has a unique combination of pharmacological actions that promote wellbeing and resilience. While the concept of an "adaptogen," or herb that helps with the adaptation to stress and the promotion of homeostasis, is not widely used in Western medicine, Western science has revealed that tulsi does indeed possess many pharmacological actions that fulfill this purpose.

The medicinal properties of tulsi have been studied in hundreds of scientific studies including *in vitro*, animal, and human experiments. These studies reveal that tulsi has a unique combination of actions that include: Antimicrobial (including antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, anthelmintic), mosquito repellent, anti-diarrheal, anti-oxidant, anti-cataract, anti-inflammatory, chemopreventive, radioprotective, hepato-protective, neuro-protective, cardio-protective, anti-diabetic, anti-hypercholesterolemia, anti-hypertensive, anti-carcinogenic, analgesic, anti-pyretic, anti-allergic, immunomodulatory, central nervous system depressant, memory enhancement, anti-asthmatic, anti-tussive, diaphoretic, anti-thyroid, anti-fertility, anti-ulcer, anti-emetic, anti-spasmodic, anti-arthritic, adaptogenic, anti-stress, anti-cataract, anti-leukodermal and anti-coagulant activities. These pharmacological actions help the body and mind cope with a wide range of chemical, physical, infectious, and emotional stresses and restore physiological and psychological function [39]. Various agents have been used to expedite the healing process which is either proceeding normally or delayed. Traditional medicine involves the use of medicinal herbs as they are easily accessible and cheap. The plant *Cyanotis cristata* belongs to the family Commelinaceae. A member of this family, *Commelina benghalensis* possess wound healing activity. The root paste of *C. cristata* is used for relief of swelling and snake bite. *C. cristata* leaves possess antioxidant effect. Phytochemical analysis of the plant has shown the presence of flavonoids and tannins. There is abundant literature showing that flavonoids and tannins have wound healing property [40]. *Tribulus terrestris* is native to south-eastern and Mediterranean Europe, temperate and tropical Asia and Africa, and northern Australia. The use of TT from ancient times occurred in the traditional medicine of major cultures in these geographical areas, such as traditional Chinese

medicine, traditional Indian medicine (Ayurveda), and the traditional medicine of south-eastern Europe, and this has defined its ethnopharmacological relevance as a medicinal plant. As a traditional Chinese Medicine, it was listed as a top-grade medicine in the earliest extant Chinese pharmaceutical monograph "Shen Nong Ben Cao Jing". In Chinese Pharmacopoeia, the fruits of TT have been used for tonifying the kidneys and as a diuretic and cough expectorant that improves eyesight and for the treatment of skin pruritus, headache and vertigo, and mammary duct blockage. In India, the fruits have been used in the treatment of infertility, impotence, erectile dysfunction, and low libido in Ayurveda. In addition, the roots and fruits are considered to have cardiogenic properties. In Sudan, TT has been used as demulcent and in nephritis and the treatment of inflammatory disorders. In addition, it has been used for diuretic and uricosuric effects in Pakistan. Modern investigation showed that the chemical constituents steroidal saponins and flavonoids with the prominent anti-inflammatory and antiaging activities of TT were the main contributors to the traditional pharmacological activities [41]. The cosmopolitan presence of the *Senna* genus and its medicinal properties lead to its various traditional medicinal uses and health-promoting effects. These beneficial effects of the *Senna* genus are contributed by the diverse group of phytoconstituents present in its leaves, stem, and seeds. By phytochemical research, more than 350 compounds were extracted from *Senna*, together with forty secondary metabolites extracted from *Senna spectabilis* (DC.) These phytochemicals majorly included classes of pentacyclic triterpenes and piperidine alkaloids displaying health-promoting properties. Many of the parts such as leaves, pods, roots, and fruits of the natural plants have beneficial pharmacological properties against diseases. The studied pharmacological activities of *Senna* plants include anti-infectious, antioxidant, anticryptococcus, antitumor, antimutagenic, antiplasmodial, anti-inflammatory, anticancer, antidiabetic, wound healing, and antihelminthic activities. Some studies have shown the antidiabetic activity of *Senna* plants due to the content of phenols and flavonoids. The antidiabetic effects have as mechanisms the decrease of the expression levels of different adipokines and the reduction of glucose absorption [42]. *Aloe vera* has been traditionally used to treat skin injuries (burns, cuts, insect bites, and eczemas) and digestive problems because its anti-inflammatory, antimicrobial, and wound healing properties. Research on this medicinal plant has been aimed at validating traditional uses and deepening the mechanism of action, identifying the compounds responsible for these activities. The most investigated active compounds are aloe-emodin, aloin, aloesin, emodin, and acemannan. Likewise, new actions have been investigated for *Aloe vera* and its active compounds. The promising results of these studies in basic research encourage a greater number of clinical trials to test the clinical application of *Aloe vera* and its main compounds, particularly on bone protection, cancer, and diabetes [43].

The genus *Indigofera* is known to contain some economically important indigo dye-producing species, such as *I. tinctoria* and *I. suffruticosa*. Species of this genus are also important pasture legumes and are used for crop shading, soil protection, green humus covering, erosion control and as ornamental plants. They are also used for their medicinal properties, and this use has a long history. Indeed, it has been reported that *I. tinctoria* seeds were used by people in medieval Cairo (10th century) to treat skin diseases, swellings and wounds. Different parts of the plants are employed, mainly leaves and aerial parts, against a wide range of ailments, including digestive and skin disorders, and to relieve pain [44]. *Ocimum filamentosum* heals the breath and give sustain body muscle strength said by ancestors, Ethnomedicinal value quantified plant in the Karnataka region [45]. *Hexasepalum teres* Used to treat fever and malaria [46]. The plant *Ageratum conyzoides* L. family Asteraceae is locally known as billygoat weed and Sadhandhi in India. It is used as traditional medicine for the treatment of numerous ailments such as analgesic, antifungal, wound healing, anti-

inflammatory, hemostatic, smooth muscle relaxant, and anticoagulant activity. The plant has several phytoconstituents such as trans-cadina-1(6), 4-diene, hexanal, β -copaene, caryophylla-4(12), 8(13)-diene-5- β -ol and 1, 10-di-epi-cubenol. Even through many of the investigational studies validated its traditional therapeutics uses, but unemployed uncharacterized crud extracts. Pharmacological activities of plant extracts and individual phytoconstituents have discovered analgesic, antifungal, wound healing, anti-inflammatory, hemostatic, smooth muscle relaxant, and anticoagulant activity. The results of few pharmacological studies and bioactive metabolites already reported in *A. conyzoides* [47].



Plate 1: Some collected medicinal plants of study areas

Andrographis echinoides (L.) is an annual herbaceous plant in the family Acanthaceae. Anti-inflammatory is the property of a substance or treatment that reduces inflammation or swelling. Antioxidants are substances that can prevent or slow damage to cells caused by free radicals, unstable molecules that the body produces as a reaction to environmental and other pressures. They are sometimes called "free-radical scavengers. Therefore, it is of interest to analyse the anti-inflammatory and antioxidant properties of *Andrographis echinoides* and *Andrographis paniculata*. Protease inhibitor activity was done by bovine serum albumin was added to 100 μ l of plant sample with increase in concentrations (100–500 μ g/ml). Invitro antioxidant activity was done by DPPH free radical scavenging assay. 200 μ L of 0.1 mM DPPH prepared in methanol was added to 100 μ L of the plant extract with increase in concentration. Based on the results from the present study, it can be concluded that *A.echinoides* is found to be a good natural antioxidant source and *A. paniculata* is found to be a good anti-inflammatory source. However, both the plant *A.echinoides* and *A.paniculata* have these properties. Data shows that both *A.echinoides* and *A. paniculata* have potential anti-inflammatory and antioxidant activity which could be due to the presence of bioactive compounds present in the plant extracts [48].

Avartaki (*Senna auriculata* (L.) Roxb. syn. *Cassia auriculata* L.; Family- Fabaceae) is a traditional medicinal plant, widely used for the treatment of various ailments in Ayurveda and Siddha system of medicine in India. Almost all the parts of the plant, such as flowers, leaves, seeds, barks, and roots have been reported for their medicinal uses. Traditionally, it has been used in the treatment of diabetes, asthma, rheumatism, dysentery, skin disease, and metabolic disorders. The principal

phytochemicals in *Senna auriculata* (L.) Roxb. are alkaloids, anthraquinone, flavone glycosides, sugar, saponins, phenols, terpenoids, flavonoids, tannins, steroids, palmitic acid, linoleic acid, benzoic acid 2-hydroxyl methyl ester, 1-methyl butyl ester, resorcinol, α -tocopherol- β -D-mannosidase, epicatechin, ferulic acid, quercetin-3-O-rutinoside, quercetin, proanthocyanidin B1. The extracts from its different parts and their isolated compounds possess a wide range of pharmacological activities such as antidiabetic, antioxidant, anti-inflammatory, antihyperlipidemic, hepatoprotective, nephroprotective, cardioprotective, anti-atherosclerotic, anticancer, antimutagenic, antimicrobial, antiulcer, antipyretic, anthelmintic, immunomodulatory, antifertility, anti-venom, and anti-melanogenesis. The toxicological findings from preclinical studies ensured the safety of the plant, but comprehensive clinical studies are required for the safety and efficacy of the plant in humans [49].

Conclusion

Forty-five wild medicinal plants from 19 different families are documented. The enumerated medicinal plants have several pharmacological uses. The study indicates the potential of available medicinal plants in the study areas. The conservation actions are needed in the study areas for sustainable uses.

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