
Traditional Phytotherapy by Medicinal Plants: A Review

12

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Abstract

This reviewed chapter deals with important ethno-medicinal plants used as anti-cancer, anti-viral, anti-bacterial, anti-oxidant and anti-asthmatic plants. A wide variety of medicinal plants are being used as a primary source against various diseases in different systems of medicine like Ayurveda, Siddha, and Unani. The traditional knowledge of medicinal plants has been an integral part of our lifestyle since ancient times. Plants around the world have special medicinal and diagnostic properties. Medicinal plants contain various phytochemical compounds like alkaloids, flavonoids, steroids, phenols, tannin, glycosides, etc. This chapter has been extensively reviewed for the use of different plant parts containing active phytochemicals and their response on different types of diseases. Different plant species synthesize metabolites that possess many biological activities such as anti-diabetic, anti-oxidant, anti-cancer, anti-viral, anti-bacterial, anti-asthmatic, anti-inflammatory etc. that have been used in drug development through clinical trials. Synthetic drugs have a narrow therapeutic window with several adverse side effects. Due to this disadvantage of synthetic drugs, there is a growing trend in the field of research to find new and reputable medicines based on the development of various herbs.

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1. Introduction

India is called the Medicinal Garden of the world due to its richness in medicinal plants. Climate diversity and geographical diversity in India are enhancing the biodiversity of plants and animals. Plants were used as medicine in ancient times and are called “Backbone” of traditional medicine. More than 3.3 billion people of the less developed countries are still dependent upon medicinal plants. The Rig-Veda, written between 4500 BC and 1600 BC is one of the oldest important document that emphasize knowledge of medicinal herbs. Indian healers, such as Maharshi Charaka and Sushruta worked to prepare various herbal remedies for various ailments of the human body. In addition to the achievement of allopathic medicines, Indian medicinal system known as Ayurveda, Unani, Siddha, and Naturopathy continue to provide medication for many ailments in India. In India, knowledge of plants and their medicinal properties is as old as human culture. According to the World Health Organization (WHO), 80% of the population use plant species as traditional medicine in health care.

People rely on plants for food, shelter, clothing and medicine. Medicinal plants and related information are threatened due to environmental degradation, deforestation and modernization. The traditional knowledge of medicinal plants is popular between local and traditional communities. Traditional communities rely mainly on herbal remedies for medicine. The traditional knowledge of the use of herbal remedies is passed on from generation to generation. Medicinal plants are the rich resources of ingredients that can be used in drug formulation. Globally, natural herbs have an important role in the development of human culture. The WHO reported in 2007 that the plant-derived drugs trade was worth US\$100 billion. The trade is expected to reach US\$5 trillion by 2050 (Rajeswara et al. 2007).

In the Modern Era, many people are suffering from cancer, diabetes, obesity, depression, heart and chronic diseases by lack of physical activity, eating too much fat, sugar, salt, and other unhealthy toxic cocktail of chemicals and environment pollution. The solution to this health crisis is to change our lifestyle and adopt traditional medicinal knowledge. In many complex cases like cancer, the plant

components have been shown to work very well. So, keeping this in mind few ethnomedicinal plants are discussed in this chapter.

2. Anti-cancer Plants

Cancer has always been an ongoing battle in the world with great advances in treatment as well as preventive treatments. Many plant species have been used from ancient times and are still used as the primary source to cure or prevent the growth of cancer. Cancer is a non-communicable disease and one of the leading cause of death. Every year, cancer kills ~3500 million people of the world. Chemotherapy is a major treatment for cancer but sometimes chemotherapeutic drugs cause toxicity and create problems in human body. The use of medicinal plants is safer for the treatment of cancer. A recent survey report claims that more than 60% of cancer patients use herbal medicine for the treatment of cancer. The National Cancer Institute (NCI) documented approximately 35,000 plant species and around 114,000 plant extracts which have anticancer properties (Vickers 2002). Plants having anti-cancer properties are discussed below:

2.1. *Taraxacum officinale*

Taraxacum officinale (G.H. Weber ex Wiggers) normally known as dandelion belongs to family Asteraceae (Figure 1). It is a perennial herb which is found in Asia, North America, and Europe. It contains many phytochemicals such as phenolic acids (chlorogenic acid, caffeic acid, and chicoric acid), sesquiterpene lactones (taraxacolide-O- β -glucopyranoside, taraxacoside, ixerin D, taraxinic acid), flavonoids (luteolin-7-glucoside, chrysoeriol and equercetin) polysaccharides (inulin), sterols (taraxasterol, stigmasterol, β -sitosterol) and carotenoids. This plant has been reported to show anti-cancer activity against breast and prostate cancer. The extracts of this plant can block proliferation and growth of different types of cancer cells like colorectal, human leukemia, pancreatic and prostate cancer cells. The young leaves are used as salad and vegetable dishes because they contain high concentration of vitamins, minerals, essential fatty acids and fibres (Escudero et al. 2003). *T. officinale* also exhibit diuretic, hepatoprotective, anticolitis, immunoprotective, antiviral, antifungal, antibacterial, antiarthritic, antidiabetic, antiobesity, antioxidant properties (Di Napoli and Zucchetti 2021).



Figure 1: *Taraxacum officinale*

2.2. *Cedrus deodara*

Cedrus deodara (Roxb.) Loud normally known as Deodar belongs to family Pinaceae (Figure 2). It is native to the Western Himalayas in North-Central India, Western Nepal, Northern Pakistan, South-Western Tibet and Eastern Afghanistan (Chaudhary et al. 2011). The chemical constituents of *Cedrus* are lignans, terpenes, flavonoids, phenolic compounds, and glycosides. *C. deodara* exhibit various pharmacological activities such as antiviral, anti-inflammatory, antispasmodic, antidiabetic, antimalarial and antibacterial. The wood or bark or essential oil from tree is widely used for sleeplessness, traumatic injury, eczema, rheumatoid arthritis, ascariasis, and edema. Flavonoids and lignans derived from cedar wood exhibit anti-cancer properties. Lignans are anticancer food compounds which show the potential for therapeutic benefits so it can be considered as alternative to chemotherapeutic drugs (Shi et al. 2019). *C. deodara* exhibit maximum anticancer activity against three cell lines (Gaidhani et al. 2013).



Figure 2: *Cedrus deodara*

3. Anti-inflammatory Plants

Inflammation is our body's protective response to dangerous stimuli including allergens and/or tissue damage; on the other hand, the uncontrolled inflammatory response is a major cause of the development of many disorders including allergies, cardiovascular dysfunctions, cancer, metabolic syndrome, and autoimmune diseases imposing a huge economic burden on individuals and consequently in society. Herbs and spices in Indian kitchen exhibit great role as anti-inflammatory agent (Ghasemian et al. 2016). Plants having anti-inflammatory properties are discussed below.

3.1. *Curcuma longa*

Curcuma longa Linn. commonly known as Turmeric or Haldi belongs to Zingiberaceae family (Figure 3). *Curcuma* contains three curcuminoids as curcumin (diferuloylmethane), demethoxycurcumin and bisdemethoxycurcumin, volatile oils (turmerone, atlantone, and zingiberone), sugars, proteins, and resins. The rhizome of this plant has been used as spice in Indian kitchens since ancient times. Curcumin is the most important compound responsible for the anti-inflammatory effect. This plant has many pharmacological activities like antioxidant, antimicrobial, anticancer etc.. It is also used for the treatment of arthritis, pancreatitis, chronic anterior uveitis etc. The rhizome is used to cure inflammatory problems. In India, it has been used for centuries as a spice and food preservative, as well as for its various medicinal properties (Aggarwal et al. 2009).



Figure 3: *Curcuma longa*

3.2. *Urtica dioica*

Urtica dioica L. normally known as stinging nettle or Bichu Butti belongs to Urticaceae family (Figure 4). It is a perennial herb which is found in temperate and tropical region. It grows mostly in shady and moist places. The compounds of this plant are

beta sitosterol, erucic acid, trans ferulic acid, rutin, dotriacotane, scopoletin, quercetin, p-hydroxylbenzalcohol and ursolic acid. This plant shows anti-inflammatory, antibacterial, anticancer, anti colitis, antioxidant, antiulcer, antimicrobial, immunomodulatory, analgesic natriuretic, hepatoprotective, antiarthritis and antiviral activities. Traditionally, the leaves and roots of this plant are used orally as a blood purifier, and to cure jaundice, menorrhagia, haematuria, rheumatism, eczema, anaemia, nephritis, and diarrhoea. Leaf extract has been used as an anti-inflammatory remedy in rheumatoid arthritis as it suppresses the cytokine production (Loshali et al. 2019). Upon touching, this plant cause skin irritation (Farzami et al. 2003).



Figure 4: *Urtica dioica*

4. Anti-viral Plants

Many viral infections remain a danger to humans and often cause death. Currently, viral infections such as Acquired Immuno Deficiency Syndrome (AIDS), Ebola virus, influenza and Severe Acute Respiratory Syndrome (SARS) are more aggressive. For example, influenza infection is seen in more than 3 million cases and causes 300,000–500,000 deaths per worldwide year. Various plant species have been used medicinally since ancient times and are known for their strong medicinal properties. Many natural plant products have anti-viral activities and show significant pharmacological and biological activities for the treatment of infectious diseases. Plants having anti-viral properties are discussed below.

4.1. *Boerhaavia diffusa*

Boerhaavia diffusa L. commonly known as ‘Punarnava’ belongs to Nyctaginaceae family (Figure 5). It is a perennial creeping herb found in tropical and subtropical regions. *Boerhaavia diffusa* contains many compounds as flavonoids, alkaloids, steroids, triterpenoids, lipids, lignins, carbohydrates, proteins, and glycoproteins,

punarnavine, boeravinone, larabinofuranoside, ursolic acid, punarnavoside, lirodendrin, and a glycoprotein. Punarnava also contains arachidic acid, β -sitosterol, palmitic acid, ester of β -sitosterol, hexacosanoic, stearic, ursolic acid, β -ecdysone, and triacontanol. Roots are diuretic, laxative and taken orally for the treatment of anasarca, ascites, and jaundice. The leaves are taken as a vegetable and the root juice for the treatment of asthma, urinary disorders, leucorrhoea and rheumatism. The plant parts of punarnava possess many pharmacological, clinical, and antimicrobial properties. *B. diffusa* root extracts exhibit high antiviral activity (Mahesh et al. 2012).



Figure 5: *Boerhaavia diffusa*

4.2. *Andrographis paniculata*

Andrographis paniculata (Burm.f.) Nees known as Kalmegh or “king of bitters” belongs to Acanthaceae family (Figure 6). It is an annual herb distributed in India, Sri Lanka and Pakistan. The main bioactive phytoconstituents of *Andrographis* are andrographolide, neoandrographolide and deoxyandrographolide, other phytochemicals such as andrographiside, andrographon, 14-deoxyandrographolide, deoxyandrographiside, andrographan, andrographosterin, and stigmasterol are also present. Major bioactive compounds have the antiviral inhibitory effects without any toxicity. Andrographolide is an important bioactive compound which is found in various parts of *A. paniculata* but leaves contain the highest amount. Andrographolide have many biological activities like anti-inflammatory, antiallergic, anti-HIV, antiplatelet aggregation and hepatoprotective. Leaves and stems have medicinal value and are used for treating cardiovascular disease, body pain, fever, snake bite, respiratory disorders, allergic reactions, cancer, and viral diseases (Jayakumar et al. 2013).

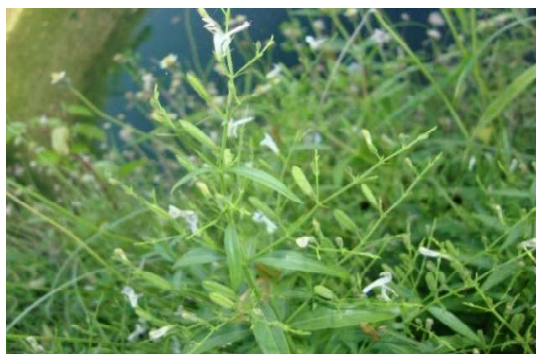


Figure 6: *Andrographis paniculata*

5. Anti-bacterial Plants

Nature has provided many medicinal plants which may be used as supplements along with moderately sensitive antibiotics which can eradicate multidrug-resistant bacteria. Antibiotic resistance occurs when the bacteria change in some way reducing or eliminating the use of drugs, chemicals, or other agents designed to treat or prevent diseases. Bacteria survive and continue to replicate causing further damage. Many plant species have antifungal, antibacterial and antiprotozoal properties that can be used systematically or locally. Neem leaves extract/paste is one of the most widely used antiviral agent in chickenpox. The indiscriminate use of antibiotics promotes the development of antibiotic-resistant bacteria by genetic modification and other methods. By the regular intake of antibiotics, sensitive germs are killed but resistant germs may be allowed to grow and multiply (Kamath et al. 2016). Plants having anti-bacterial properties are discussed below.

5.1. *Azadirachta indica*

Azadirachta indica L. commonly called Neem belongs to Meliaceae family (Figure 7). It is commonly found in tropical and semitropical regions like India, Pakistan, Bangladesh, and Nepal. The most important active constituent is azadirachtin and others are nimbolinin, nimbin, nimbidin, nimbidol, quercetin, gedunin, sodium nimbinate, salannin, β -sitosterol, polyphenolic and flavonoids. The fresh leaves have antibacterial and antifungal properties. Seeds contain gedunin and azadirachtin. Leaf extract shows strong antimicrobial activity. Different parts of neem (leaf, bark, and seeds) show wide pharmacological activities like anti-mutagenic, anti-malarial, anti-oxidant, anti-carcinogenic, anti-inflammatory, anti-hyperglycaemic, antiulcer, and anti-diabetic. Neem is also

very helpful in removing toxins from the body and purifying the blood. Many studies have shown that leaf extract of *A. indica* has powerful antibacterial activity against many bacterial pathogens (Mohammed and Omer 2015).



Figure 7: *Azadirachta indica*

5.2. *Moringa oleifera*

Moringa oleifera Lam known as Drumstick or Sahjan belongs to Moringaceae family (Figure 8). It is a fast-growing softwood tree distributed in tropical and subtropical areas. The *Moringa* plant contain zeatin, quercetin, beta-sitosterol, caffeoylquinic acid and kaempferol. The leaves and bark extracts have been tested against multi-drug-resistant bacteria. The ethanol extracts of leaves and bark show a zone of inhibition bigger than the control antibiotic. The roots, seed, bark, fruit, leaves, flowers, and immature pods of this plant act as cardiac and circulatory stimulants and also have antihypertensive, antipyretic, antitumor, anti-inflammatory, antiepileptic, antiulcer, antispasmodic, hepatoprotective, diuretic, cholesterol-lowering, antioxidant, antidiabetic, antibacterial and antifungal properties (Kamath et al. 2016).



Figure 8: *Moringa oleifera*

6. Anti-oxidant Plants

Free radical-mediated damage can play a role in many diseases, especially heart disease, cancer, neurodegenerative diseases, diabetes, Alzheimer's, and inflammatory diseases. Under stress, our body produces free radicals either reactive oxygen species (ROS) or non-enzymatic antioxidants and enzymatic antioxidants. Free radicals cause cell damage and health problems. To overcome this problem, one's diet should be filled with available antioxidant compounds present in natural plant sources. Antioxidant compounds in fruits and vegetables are the good sources to protect the human body from reducing free radicals. Lots of natural antioxidants have been used in food since ancient time. The antioxidant phytochemicals of plants, particularly polyphenols and flavonoids have vital role in inhibiting the propagation of free radical reactions. Vitamin A, C, E, carotenoids, ascorbic acid and selenium also show strong antioxidative activity. Plants having antioxidants are discussed below.

6.1. *Centella asiatica*

Centella asiatica L. known as Indian pennywort or Mandookaparni belongs to Apiaceae family (Figure 9). It is a small creeping perennial herb growing in moist places. It is found in subtropical and tropical areas like India, Sri Lanka, Pakistan, Indonesia, South Pacific, Malaysia etc. *Centella asiatica* is a "Brain tonic". It is used as a traditional and alternative medicine in India and other parts of the world since ancient times. It is commonly used as a juice, tea, and as vegetable. This plant shows many therapeutic activities such as anti-inflammatory, anti-apoptotic, antioxidant, wound healing, and memory-enhancing. The phytochemicals of *C. asiatica* are triterpene saponosides (asiatic acid, asiaticoside, madecassic acid), polyphenol compounds and flavonoid. These compounds have higher antioxidant activity. The leaves contain the highest phenolic contents than other plant parts. *Centella* is an alternative natural antioxidant and is very protective against age-related changes in the brain (Jhansi and Manjula 2019). The natural antioxidant extract has shown wide pharmacological activities as neuroprotective agent and in brain improvement.



Figure 9: *Centella asiatica*

6.2. *Asparagus racemosus*

Asparagus racemosus Willd. commonly known as Shatawari (wari “curer”) (curer of a hundred diseases), belongs to Asparagaceae family (Figure 10). *A. racemosus* is found in India and Sri Lanka. The main constituent is steroidal saponins (Shatvarin I to VI), found in the roots and other constituents are oligospirostanoside, flavanoids (rutin, glycosides of quercitin, hyperoside), cyclic hydrocarbon (racemosol, dihydrophenantherene), furan compound (racemofuran), polycyclic alkaloid (aspargamine A) which are present in fruits and flowers. The root extract showed antioxidant, antiulcer, antidiabetic, antidiarrhoeal, and immunomodulatory activities. The root of *Asparagus* is bitter-sweet in taste and is stomachic, diuretic, carminative, emollient, cooling, galactagogue, aphrodisiac, antiseptic, rejuvenating, and constipating. The methanolic extract of *A. racemosus* shows antioxidant activity through free radical scavenging (Alok et al. 2013).



Figure 10: *Asparagus racemosus*

6.3. *Terminalia arjuna* (Roxb.) Wight & Arn.

Terminalia arjuna commonly known as Arjuna is a very beneficial ethnomedicinal plant used for many critical diseases (Figure 11). Arjuna belongs to Combretaceae family. *Terminalia arjuna*, found in India, Sri Lanka, Burma etc., is an evergreen large tree. The main chemical constituents are tannins, triterpenoids, flavonoids, sterols, saponins, polyphenols, mainly found in bark-The bark of Arjuna is used for the treatment of heart diseases like cardiomyopathy, heart failure, myocardium necrosis, atherosclerosis. along with anemia, blood disease, ulcer, and fracture *T. arjuna* possess antibacterial, antimicrobial, antifertility, antiallergic, antitumoral, hypocholesterolemic activities. The leaf extract show antioxidant activity (Singh et al. 2011).



Figure 11: *Terminalia arjuna*

7. Anti-asthmatic Plants

Asthma is a common chronic condition, characterized by respiratory symptoms caused by smoking, environmental pollution, family history and exposure to allergens. Globally, 300 million people in the world are suffering from Asthma (Bousquet et al. 2005). In ancient Indian Medicinal System, several pollen or plant sources have been described as cause of asthma. Medicinal plants which have immunomodulatory, anti-inflammatory, anti-histaminic, antiallergic and smooth-muscle relaxants activity are used to treat asthma (Geenberger 2003). According to Ayurveda, an anti-asthmatic drug should have anti-Kapha and anti-Vata properties (Lyengar et al. 1994). Ayurveda and other literature have mentioned many medicinal plants and their bioactive compounds which show antiasthmatic, antiallergic, anticholinergic, and antihistaminic activity (Taur and Patil 2011). Plants having anti-asthmatic properties are discussed below.

7.1. *Tylophora indica*

Tylophora indica (Burm. F) Merrill known as Indian Ipecse or Antmool, belongs to Asclepiadaceae family (Figure 12). It is a threatened, twining and perennial herb. It is distributed in Southern and Eastern India. Mostly, it is found in moist forests, plains, and hilly areas. It also grows in highlands up to 1000 m in Assam, Bengal, Odisha and South India. There are about 60 species in the Asia, Africa and Australia as well as about 35 species reported from China. *Tylophora* plant contains alkaloids such as tylophorinin, septicine, tylophorine, tylophoricine, tylophorinidine, isotylocrebrine, phytosterols, wax, flavonoids, tannins, and resin. The dried leaf powder of *Tylophora* is taken daily to treat asthma. It also has laxative, expectorant, diaphoretic, stimulant, emetic, and cathartic properties. It is also very effective as anti-psoriasis drug. *Tylophora* species are now in high demand worldwide for their proven efficacy against asthma (Sabitha Rani et al. 2012).



Figure 12: *Tylophora indica*

7.2. *Cassia sophera*

Cassia sophera Linn known as Sophera Senna or Kashaunda belongs to Caesalpiniaceae family (Figure 13). In ayurvedic literature, *C. sophera* is also known as “Kasmard” which means cough suppressant. It is an evergreen herb found in India and most tropical countries. It is used traditionally to cure asthma. *Cassia* contains many constituents such as dehydroascorbic acid, β - sitosterol, anthraquinone sopheranin, chrysophenol, physcion, emodin and cyclosporoside A. The roots, leaves and seeds possess pharmacological activities like antiasthmatic, anti-inflammatory, anticonvulsant, antioxidant, anti-rheumatic, anti-bacterial, hepatoprotective, etc. Seeds are anthelmintic, tonic for eyes and cure skin diseases. The plant is used for fever, herpes, malaria, cough, headaches, ophthalmia, scabies

and pneumonia. The plant decoction is antidiuretic and is used for asthma and bronchitis. Roots are used for ringworm, elephantiasis, and scorpion stings. The leaves are aphrodisiac, alexiteric, and stomachic, and are used for asthma, biliousness cough, hiccups, and sore throat. Root, seeds, stem and bark act as an expectorant and are efficacious in acute bronchitis (Dwivedi and Thakur 2021).



Figure 13: *Cassia sophera*

8. Anti-diabetic Plants

Diabetes is a global problem and has risen dramatically day by day. Diabetes mellitus is a chronic and endocrine metabolic disease characterized by high levels of sugar in the blood due to insulin dysfunction, insulin secretion or both. Diabetes is associated with chronic injuries, dysfunction and eventually organ failure especially the eyes, heart, blood vessels, kidneys and nerves. It harms lipid, carbohydrate and protein metabolism leading to chronic hyperglycemia and abnormal lipid profile. Several plant species are rich in alkaloids, phenolics, glycosides, terpenoids, flavonoids and coumarins that show antidiabetic potential. WHO reported that diabetes will be the seventh leading cause of death in 2030 (Kakkar 2016). In one survey, 2.8% people of the world are suffering from diabetes and will be increased to more than 5.4% in 2025 (Mukesh and Namita 2013). Currently, many treatments like diet therapy, pharmacotherapy and insulin therapy are used to control this disease. Plants having antidiabetic properties are discussed below.

8.1. *Trigonella foenum-graecum*

Trigonella foenum-graecum Linn. known as fenugreek or methi belongs to Fabaceae family (Figure 14). It is an annual herb that is cultivated throughout the world and India is the major exporting country (Zimmer 1984). The seeds of this plant are used as spices in the Indian kitchen from ancient times that possess antidiabetic,

antioxidant and antihyperlipidemic properties. The chemical constituents present in the plant are saponins, hydroxyisoleucine, 4-hydroxyleucine/4-trigonelline, diosgenin, alkaloid and high fibre which are responsible for its therapeutic potential. The seed powder is used orally for 10-15 days to cure fast-reducing blood sugar. It also helps in reducing the risk of the atherosclerosis, hyperlipidemia, and hypertension. It has been proved to be very helpful for diabetic patients. Diabetic retinopathy, neuropathy and other diabetic complications can be prevented by fenugreek seeds. Fenugreek seed powder extract showed neuroprotective effect by decreasing hyperglycemia and oxidative stress (Mooventhana and Nivethitha 2017). The sprouted seeds are taken to treat dysentery, heart diseases, hormonal disorders, respiratory diseases, hypoglycaemia, etc.



Figure 14: *Trigonella foenum-graecum*

8.2. *Holostemma annularis*

Holostemma annularis K. Schum known as Arkapushpi belongs to Asclepiadaceae family (Figure 15). It is found in Southern Asia. *Holostemma* is a twining shrub; roots contain many constituents such as β -sitosterol, lupeol, and alpha-amyrin and have both antioxidant and anti-diabetic properties. Roots are used in the treatment of cough, fever, orchitis, burning sensation, ophthalmopathy and tridoshas. The paste of flower is applied externally in insect bites and itching skin. The plant is also used to cure gonorrhoea, blood disorder and ulcer. The root contains an antioxidant compound, (sitosterols and lupeol), which may be responsible for its hypoglycemic effect. Traditionally, the roots are pounded in a paste and taken with cold milk for treating diabetes (Avanapu and Dachani 2013).



Fig. 15: *Holostemma annularis*

8.3. *Costus* sp. (Insulin plant)

Costus speciosus Koen. (Keu) or *Cheilocostus speciosus* commonly known as spiral flag, crepe ginger and step ladder belong to the family Costaceae (Zingiberaceae) (Figure 16A). It occurs in moist tropical evergreen forests at an altitude of above 1100m. It is erect and perennial in habit. The rhizome of *C. speciosus* contain many chemical constituents such as saponin, triterpenes, oxa-acids, aliphatic hydroxyl ketons, tigogenin, corticosteroids, β -amyrin, alpha-amyrin stearate etc. and the seeds contain dihydropyrylplastoquinone. The rhizome is of great medicinal value. The bioactive molecule which exhibits antidiabetic properties in *C. speciosus* is a phytosteroid saponin known as disogenin (Sarin et al. 1974; Pawar and Pawar 2014). In *Costus speciosus*, raffinose decreases the synthesis of lipid through changes in PPARs/SREBP1c and it improves the insulin sensitivity directing PI3K/AKT pathway (Muthukumaran et al. 2018). The juice of rhizome is also used for headache, urinary diseases, dropsy, pneumonia, rheumatism and to improve digestion. The leaves are used against dyspepsia, diarrhoea, cold, cough and snake bite. The rhizomes are bitter which have anthelmintic, cooling, purgative, aphrodisiac, expectorant, properties. This plant is also known as “insulin plant”. Another species *Costus pictus* commonly known as American Insulin Plant was introduced recently in India (Figure 16B). Flavonoid quercetin is present in the leaves which exhibit antidiabetic, antioxidant and hepatoprotective properties (Selvakumarasamy et al. 2021). The leaves of *Costus pictus* (American Insulin plant) and the rhizome of *Costus speciosus* (Indian Insulin plant) are good source to lower down the blood sugar level due to hypoglycemic properties (Azhagu and Ganesan 2021; Sharma and Sharma 2021).



Figure 16: A) *Costus speciosus* and B) *Costus pictus*

9. Conclusion

Medicinal plant species play a vital role in health care system. The phytochemicals of plant species are mainly responsible for many biological activities such as anti-proliferative, antioxidant, anti-diabetic, anti-estrogenic, anti-inflammatory, analgesic, antibacterial, immunomodulatory effects, hepatoprotective, anti-viral, and anti-asthmatic. However, many other active agents of herbs have not been well identified. More investigations must be carried out to evaluate the mode of action and preparation of medicinal plants drugs with their biological activities. Majority of people depends on plant-based remedies or traditional medicinal plants for common health disorders such as cold, fever, headache, boils, ulcer, wound, skin diseases, diarrhoea, urinary troubles, constipation, etc. and has deep faith in them. Natural products and herbs are safe without any side effects. The synthetic drug attacks the targets blindly thus affecting and disturbing the other system, while herbal medicines work well without any disturbance and damage to any system of the body. Natural medicines are safe, effective, cheaper and easily available. Hence, the conservation of traditional medicinal knowledge is essential and we should ensure that the future generation keeps the traditional heritage intact.

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