PHYTORESOURCES AS POTENTIAL THERAPEUTIC AGENTS FOR CANCER TREATMENT AND PREVENTION

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Abstract:: Cancer is the second leading cause of death, where one in four deaths is due to cancer. It has been regarded mainly as a group of diseases afflicting more developed and developing countries. The incidence of various forms of cancer is now rapidly rising worldwide. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. As such herbal remedies have been used to cure cancer. The use of plant products in the treatment of cancer has been of recent interest. In the present review-medicinal plants, the promising sources for biologically active compounds having anticancer properties, the goals of using them as sources of therapeutic agents and their role in the discovery of leads for the development of conventional drugs for the treatment of cancer are reviewed. The use of plant drugs is increasing, it is obvious that an increased use of plant drugs will be followed in the future. India inherited long lasting system of medicine ‘Ayurveda’ where plant products are utilized as remedies for various diseases and disorders. The enrichment of these health care measures and scientific studies on the derivation of drugs through bioprospecting and systematic conservation of the medicinal plants are thus of great importance.

Key Words: Medicinal plants, Cancer, Prevention, Treatment

INTRODUCTION

For ages plants have been a good source of food and they provide essential nutritional values, medicinal properties and notable physiological effect to life [1]. An individual’s genes, environment, and diet have long been acknowledged contributors to cancer; however, the underlying mechanisms have been unclear and “black boxed” in the past. Cancer has been regarded mainly as a group of diseases afflicting the more developed countries; the incidence of various forms of cancer is now rapidly rising worldwide. It was estimated that there were 10.9 millions new cases, 6.7 million deaths, and 24.6 million persons living with cancer around the world in a year [2]. Cancer is the second leading cause of death [3], where one in four deaths is due to cancer. Advancements in scientific research, however, have enabled researchers to begin characterizing and understanding the mechanisms that cause cancer. Finally, the “black box” has been opened and scientists can begin formulating a true understanding of the underlying causes of cancer. The first written records on the medicinal uses of plants appeared in about 2600 BC from the Sumerians and Akkaidians [4]. The “Ebers Papyrus”, the best known Egyptian pharmaceutical record, which documented over 700 drugs, represents the history of Egyptian medicine dated from 1500 BC. The Chinese Materia Medica, which

describes more than 600 medicinal plants, has been well documented with the first record dating from about 1100 BC [5]. Documentation of the Ayurvedic system recorded in Susruta and Charaka dates from about 1000 BC [6]. The Greeks also contributed substantially to the rational development of the herbal drugs. Dioscorides, the Greek physician (100 A.D.), described in his work “De Materia Medica” more than 600 medicinal plants [4].

Traditional medicine (TM) refers to the application, approach, knowledge, and belief in incorporating plant or animal based properties in remedies, singularly or in combination, for the purpose of treating or preventing disease as well as to maintain the well-being of an individual. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments [7]. As such herbal remedies have been used to cure a variety of disorders or conditions such as diabetes, cardiovascular problems, weight control, dermal infirmities, sexual malfunction, and of course cancer. According to the World Health Organization, more than 70% of the world’s population uses TM in order to fulfill their health necessities [8]. In various oriental countries such as China, traditional medicine account for about 30%-50% of total medicinal intake. Other countries like the United Kingdom have an annual expenditure on traditional medicine of US$230 million. In the United States, it is estimated that 158 million of the adult population use traditional medicine as alternative or complementary medicines and according to the USA Commission for Alternative and Complementary medicines, close to US$17 billion was spent on traditional remedies in 2000.

The natural world has been providing life-saving antibiotics, nutritive supplements and our most potent anti-cancer drugs. The lush tropical rainforests and colorful coral reefs of our planet have long been a source of promise in the fight against cancer and other diseases. Natural products, especially those from plants, have been a valuable source of new cancer drugs for many decades. Medicinal plants are the most exclusive source of life saving drugs for the majority of the world’s population. The use of plant products in the treatment of cancer has been of recent interest [9]. In the market, these products are offered as "natural products" [10]. Natural products appeared to be a promising source for new types of compounds to test for antitumor activity. The goals of using plants as sources of therapeutic agents are:

- To isolate bioactive compounds for direct use as drugs, e.g., digoxin, digitoxin, morphine, reserpine, taxol, vinblastine, vincristine.

- To produce bioactive compounds of novel or known structures as lead compounds for semi synthesis to produce patentable entities of higher activity and/or lower toxicity, e.g., metformin, nabilon, oxycodeon [and other narcotic analgesics], taxotere, teniposide, verapamil, and amiodarone, which are based, respectively, on galegine, Δ9 tetrahydrocannabinol, morphine, taxol, podophyllotoxin, and khellin.

- To use agents as pharmacologic tools, e.g., lysergic acid diethylamide, mescaline, yohimbine [11].

In many instances, however, the “cancer” is undefined, or reference is made to conditions such as “hard swellings”, abscesses, calluses, corns, warts, polyps, or tumors, to name a few. These symptoms would generally apply to skin, “tangible”, or visible conditions, and may indeed
sometimes correspond to a cancerous condition. Many of the claims for efficacy in the treatment of cancer, however, should be viewed with some skepticism because cancer, as a specific disease entity, is likely to be poorly defined in terms of folklore and traditional medicine. This is in contrast to other plant-based therapies used in traditional medicine for the treatment of afflictions such as malaria and pain, which are more easily defined, and where the diseases are often prevalent in the regions where traditional medicine systems are extensively used. However, despite these observations, it is significant that over 60% of currently used anti-cancer agents are derived in one way or another from natural sources, including plants, marine organisms and microorganisms. Indeed, molecules derived from natural sources [so-called natural products], including plants, marine organisms and micro-organisms, have played, and continue to play, a dominant role in the discovery of leads for the development of conventional drugs for the treatment of most human diseases.

An interaction between traditional medicine and modern biotechnological tools is to be established towards new drug development. The interface between cell biology, in vitro assays and structural chemistry will be the best way forward to obtain valuable leads. There is considerable scientific evidence to suggest that nutritive and nonnutritive plant-based dietary factors can inhibit the process of carcinogenesis effectively. The National Cancer Institute collected about 35,000 plant samples from 20 countries and has screened around 114,000 extracts for anticancer activity [12]. Of the 92 anticancer drugs commercially available prior to 1983 in the US and among world wide approved anticancer drugs between 1983 and 1994, 60% are of natural origin [5]. In this instance, natural origin is defined as natural products, derivatives of natural products or synthetic pharmaceuticals based on natural product models [13].

The search for anti-cancer agents from plant sources started in earnest in the 1950s with the discovery and development of the vinca alkaloids, vinblastine and vincristine, and the isolation of the cytotoxic podophyllotoxins. These discoveries prompted the United States National Cancer Institute (NCI) to initiate an extensive plant collection program in 1960, focused mainly in temperate regions. This led to the discovery of many novel chemotypes showing a range of cytotoxic activities, including the taxanes and camptothecins, but their development into clinically active agents spanned a period of some 30 years, from the early 1960s to the 1990s. This plant collection program was terminated in 1982, but with the development of new screening technologies, the NCI revived the collections of plants and other organisms in 1986. This time the focus was on the tropical and sub-tropical regions of the world, but it is interesting to note that no new plant-derived clinical anti-cancer agents have, as yet, reached the stage of general use. This fact is well documented in the inventory of medicinal plants, listing over 20,000 species. In spite of the overwhelming influences and our dependence on modern medicine and tremendous advances in synthetic drugs, a large segment of the world population still likes drugs from plants. In many of the developing countries the use of plant drugs is increasing because modern life saving drugs are beyond the reach of three quarters of the third world’s population although many such countries spend 40-50% of their total wealth on drugs and health care. As a part of the strategy to reduce the financial burden on developing countries, it is obvious that an increased use of plant drugs will be followed in the future.
PLANTS USED IN THE TREATMENT OR PREVENTION OF CANCER

*Allium sativum:* It is used for the treatment of cardiovascular atherosclerosis, HIV drug-induced lipid disorders, cancer prevention, colds and the flu, and tick bite prevention [14,15]. It seems to be active against erythroleukemia as well as breast and prostate cancer cells [16,17].

*Amorphophallus konjac:* Used in reduction of serum cholesterol and in constipation, control of blood glucose [18]. Luo [19] found that glucomannan protected mice against clinically induced lung cancer.

*Annona trioloba:* Acetogenins of this herb have been found to be active against certain lung and breast cancers [20]. This herb is also used to treat fever, vomiting, and oral inflammation [21].

*Arachis hypogaea:* It is used to lower cholesterol, aid in weight loss, or prevent cardiovascular conditions and cancer [22, 23].

*Aronia melanocarpa:* Aronia melanocarpa has a high concentration of polyphenols and anthocyanins, stimulating circulation, protecting the urinary tract, and strengthening the heart. Its rich antioxidant content may be beneficial as a dietary preventative for reducing the risk of diseases caused by oxidative stress. Several investigators reported to treat conditions such as colorectal cancer [24], colon cancer [25], cardiovascular disease [26] chronic inflammation [27], gastric mucosal disorders [peptic ulcer] [28], eye inflammation [uveitis] [29] and liver failure [30].

*Asparagus officinalis:* Leung and Foster, [31] reported that this possess cancer preventing property. It also has a role in controlling urinary tract infections [32].

*Asparagus racemosus:* It is useful in treating tumours, nervous disorders, dyspepsia, tuberculosis, cough, bronchitis, gleet, gonorrhoia, leucorrhoea, leprosy, epilepsy, fatigue, hyperacidity, colic haemorrhoids, hypertension, abortion, cardiac and general debility [33].

*Astragalus gummifera:* It inhibits cancer cell growth [31] and used in treating the carcinogenesis.

*Bacopa monniera:* The plant is anticancerous and improves learning ability. The plant is astringent, bitter, sweet, cooling, laxative, intellect promoting, anodyne, carminative, digestive, antiinflammatory, anticonvulsant, depurative, cardiotonic, bronchodilator, diuretic, emmenagogue, sudorfic, febrifuge and tonic [7].

*Bleekeria vitensis:* Widely used in Europe in the treatment of advanced breast cancer [34]. Elliptinium, a derivative of ellipticine, isolated from a medicinal plant *Bleekeria vitensis* A.C. Sm., is marketed in France for the treatment of breast cancer [35].

*Brassica oleracea:* Used for gastrointestinal disorders, asthma, morning sickness, and preventing osteoporosis, individuals also use it to prevent lung, stomach, colorectal, breast, and other cancers [22] Several studies reported that this may have anticarcinogenic properties [36-38].

*Camellia sinensis:* Used to prevent prostate, colon, and gastric cancers [39-40]. It is also used to prevent skin cancer or damage from ultraviolet radiation [41]. It seems to reduce the risk of some cancers by preventing blood vessel growth in tumors [42].

*Carmona retusa:* Commonly used as tea or tonic drink to treat stomach ailments and popular as antibacterial and have a high potential infighting the growth and multiplication of cancer cells [43].
Catharanthus roseus: It is one of the very few medicinal plants, which has a long history of uses as diuretic, antidysenteric, haemorrhagic and antiseptic. It is known for use in the treatment of diabetes in Jamaica and India. The alkaloids vinblastine and vincristine present in the leaves are recognized as anticancerous drugs. Vinblastine is used in combination with other anticancer agents for the treatment of lymphocytic lymphoma, Hodgkin’s disease - cancer affecting lymph glands, spleen and liver, testicular carcinoma and choriocarcinoma. Vincristine is used in acute leukemia, lymphosarcoma and Wilm’s tumour [44]. Vinblastine and vincristine are primarily used in combination with other cancer chemotherapeutic drugs for the treatment of a variety of cancers, including leukemias, lymphomas, advanced testicular cancer, breast and lung cancers, and Kaposi’s sarcoma [35].

Chrysanthemum morifolum: This may reverse precancerous gastrointestinal lesions [45].

Coleus forskohlii: It is useful in the treatment of cancer, congestive heart failure [46-47]. The active principle of Coleus forskohlii, forskolin, increase of cyclic AMP levels in the culture medium of human prostatic cancer cells thereby cellular growth of the cancer found inhibited. This will be a possible new, safe approach to prostatic carcinoma therapy [46].

Combretum caffrum: The bark of the Combretum caffrum is combined with a number of other herbs, together they form a formidable anti-cancer treatment. Varieties of anti-cancer compounds called combretastatins are found within the tree bark of Combretum caffrum the most potent of which is combretastatin CA-4. Combretastatins bind to the protein tubulin, which is essential to cytoskeletal architecture, intercellular transport, cell migration, wound healing, and mitotic spindle development for chromosome segregation and cell division. A member of the mitotic inhibitor class of anti-cancer drugs, combretastatin disrupts tumor blood vessel networks by constricting blood supply to tumours. Combretastatin A-4 is active against colon, lung and leukemia cancers and it is expected that this molecule is the most cytotoxic phytomolecule isolated so far [48,49].

Crocus sativus: It helps in increasing white blood cell count and disinfects secretions, including mucus, sweat and urination. It also increases appetite, clears the lungs, and helps heal the skin and mucous membranes. It is commonly used for cough and cold, decreased appetite and general weakness and also in the treating cancer [50].

Curcuma longa: Used to manage gastrointestinal discomfort and colorectal cancer [21]. This herb may have bile-stimulating, liver-protectant, antioxidant, and anticancer effects [18].

Daphne genkwa: The flower buds are used to control coughs. The buds are anticoagulant, antiseptic, antiviral, diuretic, purgative and stomachic [51,52]. They are used internally in the treatment of bronchitis, constipation, oedema and skin diseases [53]. Kai et al., [54] reported antitumour, antiiallergy and antiinflammatory activities.

Datura metal: The plant or the different alkaloids have anticancerous, antitumour activities and it has narcotic, anethelminthic, spasmylytic anaesthetic, sedative, ophthalmic, antiarthritic, antiastmatic, antidiarrhoal and anticitratral activities [55]. Leaf is antitumour, antirheumatic and vermicide. Flower is antiasthmatmic, anaesthetic and is employed in swellings and eruptions on face. Fruit juice is used in earache and seed decoction in ophthalmia. The alkaloids of pharmaceutical interest present in the plant are hyoscyamine, hyoscine and meteloidine.
**Dysoxylum binectariferum**: Ayurvedic plant, used for rheumatoid arthritis. Rohitukine was isolated as the constituent responsible for anti-inflammatory and immunomodulatory activity Flavopridol, was found to possess tyrosine kinase activity and potent growth inhibitory activity against a series of breast and lung carcinoma cell lines. It also showed broad spectrum in vivo activity against human tumor xenografts in mice, either alone or in combination with other anti-cancer agents, against a broad range of tumors, including leukemias, lymphomas and solid tumors [35].

**Ginkgo biloba**: Used to treat conditions like altitude sickness, asthma, depression, disorientation, headaches, high blood pressure, erectile dysfunction and vertigo. It has found to improve thinking, learning and memory in people with Alzheimers disease (AD). This herb also improves blood flow. Suzuki et al., [56] reported that extract of leaves has anti cancer activity.

**Gloriosa superba**: The roots and rhizomes are used in traditional system of medicine. Rhizome is anticancerous, oxytocic, antimalarial, stomachic, purgative, cholagogue, anthelmintic, alterative, febrifuge and antileprotic. Leaf is antiasthmatic and antiinflammatory. Root shows antigonorrhoeic and antibiotic activity [57].

**Glycine max**: The protective action of this plant on breast cancer was experimentally demonstrated by [58-60].

**Gynostemma pentaphyllum**: Used to treat cancer, cardiovascular and gastrointestinal disorders, diabetes, and obesity, and for strengthening the immune system. It is also used as an anti-inflammatory agent, antioxidant, or detoxifying agent [22].

**Hibiscus sabdariffa**: It is a medicinal herb, used in folk medicine in treatment of hypertension [61]. *Hibiscus* anthocyanins, a group of phenolic natural pigments present in the dried flower of *Hibiscus sabdariffa*, have been found to have cardioprotective [62], hypocholesterolemic [62], anti-oxidative and hepatoprotective [63] effects in animals. *Hibiscus sabdariffa* flowers stimulate proliferation and differentiation of human keratinocytes [64]. *Hibiscus* protocatechuic acid has inhibitory and inductive effect on tumour promotion in mouse skin and in human leukemia cells respectively [65]. *Hibiscus sabdariffa* has been reported to be antiseptic, aphrodisiac, astringent, cholagogue, demulcent, digestive, diuretic, emollient, purgative, refrigerant, sedative, stomachic and tonic [62].

**Kaempferia rotunda**: The tubers of Indian crocus are widely used as a local application for tumours, swellings and wounds. The tubers are antitumour, antiinflammatory, sialagogue, emetic, and vulnerary. It also improves complexion and cures burning sensation [66,67].

**Lagerstroemia speciosa**: It is popular in treating kidney troubles and serves as an anti-diuretic and its bark extract is efficient to counter cancer cells [43].

**Larrea divaricata**: Used to treat cancer, tuberculosis, and venereal disease [69]. It also has the potential for anticarcinogenic and antimutagenic activity [70].

**Lavandula angustifolia**: This plant can be used to prevent multiplication of cancer cells. In vitro and animal studies have shown anticancer activity of *L. angustifolia* [18].

**Mamordica charantia**: It has antimicrobial [71], antiviral (anti HIV) [72] antitumour [73] and antimutagenic [74] effects. In Mexico, the entire plant is used for dysentery; the root is a reputed aphrodisiac. In Peruvian herbal medicine, the leaf or aerial parts of the plant are used to treat measles, and all types of inflammation. In Nicaragua, the leaf is
commonly used for stomach pain, fevers, colds, coughs, headaches, skin complaints, menstrual disorders, aches and pains, hypertension, infections, and as an aid in childbirth.

**Nigella sativa:** Used in self-medication for gastrointestinal conditions and as an immunoprotectant against cancer [18]. Some of the studies reported that it is an anticancer agent, inhibiting stomach tumors, carcinoma, and Ehrlich ascites carcinoma [75,76].

**Olea europaea:** Used to treat breast cancer [23], others take it to prevent colorectal cancer and in cardiovascular complications [77].

**Oryza sativa:** Used in the treatment of diabetes and hypertension, cardiovascular disease [22] and bowel cancer [78].

**Oxycoccus macrocarpos:** It is used to treat or prevent cancer [22, 79-80]. Plant juice and products can reduce the number of breast cancer tumors, delay tumor development, and slow metastases of cancer to lungs and lymph nodes [22]

**Plantago ovata:** Used to treat hypercholesterolemia, hyperglycemia, and cancer [22]. Gerber, [81] reported that it decrease absorption of carcinogens and unconjugated estrogens.

**Podophyllum peltatum:** The plant has podophyllotoxin, can be used as cytostastic [82] and topically in the treatment of genital warts [83]. The plant has been used especially in the treatment of ovarian cancer [84]. Epipodophyllotoxin is an isomer of podophyllotoxin which was isolated as the active antitumor agent from the roots of Podophyllum species, *Podophyllum peltatum* Linn. [85].

**Polygonum tinctorium:** Their use increases the phagocytosis of white blood cells and decreases the permeability of the capillaries. The leaves and fruits are used to protect and the prevention of leukemia [51-52]. Koya *et al.*, [86] reported anticancer activity.

**Raphanus sativus:** The plant shows anti tumour activity. The leaves, seeds and old roots are used in the treatment of asthma and other chest complaints [52]. Synthetic agent roscovitine, an anticancer drug which is derived from natural product olomucine, originally isolated from *Raphanus sativus* L., is in Phase II clinical trials in Europe [35, 87].

**Rhus succedanea:** The fruit is used in the treatment of phthisis [88]. A wax from the fruits is used in ointments. An ethanolic extract of the leaves exhibits anticancer and antiviral activities [52]. Ethanolic extract of sap also has anticancer activity [89].

**Spinacia oleracea:** Used to treat gastrointestinal complaints and fatigue, induce blood building, and stimulate the appetite [32] and prevent cancer [90]

**Taxus brevifolia:** It contains the substance ‘taxol’ in its shoot and bark. Taxol has shown exciting potential as an anticancer drug, particularly in the treatment of ovarian cancer [53]. All parts of the plant, except the fleshy fruit, are diaphoretic and pectoral. A decoction of the branches and leaves has been used in the treatment of lung cancer [91].

**Tebebuia impetiginosa:** This plant improves quality of life for cancer and immunodepressed patients. However, the main active compound lapachol has since turned out to be toxic enough to kill a human imbibing the quantities required for a therapeutic effect on those diseases. Lapachol has strong antibiotic and disinfectant properties, and may be better suited for topical applications. Species of the genus *Tabebuia sps.* have a history of use in the treatment of several diseases, including syphilis, fevers, malaria, cutaneous infections, stomach disorders
and significant activity against a range of tumor cell lines, including breast, leukemia and prostate lines [35].

**Terminalia paniculata:** The stem bark is anticancerous, diuretic, cardiotonic CVS active and shows antagonism of amphetamine hyperactivity. Flower is anticholerin [92].

**Triticum aestivum:** Used to prevent colon cancer and other colon conditions [93-95]. It is also used in the prevention of breast cancer [96].

**Vaccinium angustifolium:** Used in the treatment for ulcers, urinary tract infections, multiple sclerosis, varicose veins, hemorrhoids [97-98]. The antioxidant effects of blueberry extracts may have anticancer activities, according to preliminary research [79].

**Vaccinium myrtillus:** This contains dense levels of anthocyanin pigments linked experimentally to lowered risk for several diseases, such as those of heart, eye and cardiovascular system and cancer [26, 99-101].

**Viscum album:** It has been employed in checking internal haemorrhages, in treating cancer of the stomach, lungs and ovaries [53]. The plant has also been used to treat arthritis, rheumatism, chilblains, leg ulcers and varicose veins, epilepsy and other convulsive nervous disorders. Cazacu et al., [102] reported anticancer activity *in vitro* and *in vivo*.

**Vitex negundo:** Used to treat chronic bronchitis. They are useful in dispersing swellings of the joints from acute rheumatism, and of the testes from suppressed gonorrhoea. The juice of the leaves is used for removing foetid discharges and worms from ulcers, while oil prepared with the leaf juice is applied to sinuses and scrofulous sores. A decoction of the stems is used in the treatment of burns and scalds [52]. Extracts of the leaves have shown bactericidal and antitumor [52] and cytotoxic activity against cancer cell lines [103].

**Yucca glauca:** Yucca is used to treat arthritis, hypertension, headaches, diabetes, and gastrointestinal conditions [31,68]. It exhibit antitumor activity against B16 melanoma but not against L1210 and P388 leukemias in mice [18, 31, 68, 93].

**CONCLUSION**

Herbs are staging a comeback and herbal ‘renaissance’ is occurring all over the globe. The herbal products today symbolise safety in contrast to the synthetics that are regarded as unsafe to human and environment. Although herbs had been priced for their medicinal, flavouring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. However, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. Green plants synthesise and preserve a variety of bioactive compounds, many of which are extractable and used as chemical feedstocks or as raw material for various scientific investigations.

Many secondary metabolites of plant are commercially important and find use in a number of pharmaceutical compounds. Over three-quarters of the world population relies mainly on plants and plant extracts for health care. It is estimated that world market for plant derived drugs may account for about Rs.2, 00,000 crores. The annual production of medicinal and aromatic plant’s raw material is worth about Rs.200 crores. This is likely to touch and US $5 trillion by 2050. It has been estimated that in developed countries such as United States, plant drugs constitute as much as 25% of the total drugs, while in fast developing countries such as China and India, the
contribution is as much as 80% [7]. Thus, the economic importance of medicinal plants is much more to countries such as India than to rest of the world. These countries provide two third of the plants used in modern system of medicine and the health care system of rural population depend on indigenous systems of medicine.

Not only, that plant-derived drug offers a stable market world wide, but also plants continue to be an important source for new drugs. Natural products discovered from medicinal plants have played an important role in the treatment of cancer. Natural products or natural product derivatives comprised 14 of the top 35 drugs in 2000 based on world sales [104]. Two plant derived natural products, paclitaxol and camptothecin were estimated to account for nearly one- third of the global anticancer market or about $3 billion of $9 billion in total annually in 2002 [105]. Of the 2,50,000 higher plant species on earth, more than 80,000 are medicinal. India is net of the world’s 12 biodiversity centres with the presence of over 45000 different plant species. India’s diversity is unmatched due to the presence of 16 different agro-climatic zones, 10 vegetation zones, 25 biotic provinces and 426 biomes [habitats of specific species]. Of these, about 15000-20000 plants have good medicinal value.

However, 7000-7500 species has been explored for their medicinal values. India also inherited the long lasting system of medicinal ‘Ayurveda’ where plant products are utilized as remedies for various disorders. These health care measures are also to be enriched and conserved. It should be taken care, some of the herbs are deadly poisonous and some are extremely dangerous. So, the scientific study on derivation of drugs through bioprospecting and systematic conservation of the concerned medicinal plants are thus of great importance.

REFERENCES


30. Valcheva-Kuzmanova S., Borisova P., Galunsk B., Krasnaliev I., Belcheva A. Hepatoprotective effect of the


85. Stahelin H. Activity of a new glycosidic lignan derivative (VP 16-


combination with other cancer chemotherapeutic drugs for the treatment of a variety of cancers, including leukemia's, lymphomas, advanced testicular cancer, breast and lung cancers, and Kaposi's sarcoma [23].

Asparagus officinalis: Leung and Foster reported that this possess cancer.


21. Gupta S., Ahmad N., Mukhtar H. Prostate chemoprevention by green tea. Cancer prevention could be achieved by avoidance of cancer causing substances and by using chemopreventive agents that can inhibit initiation and also to act as blocking and suppressing agents [6]. It is also an antioxidant and therefore plays a role in preventing some cancers [7]. The purpose of the present study was to optimize the extraction conditions for the isolation of palmatine from Tinospora cordifolia on the basis of central composite design and to understand the chemopreventive potential of palmatine in DMBA and croton oil induced skin carcinogenesis mouse model system. K. C. Mouli, T. Vijaya, and S. D. Rao, Phytoresources as potential therapeutic agents for cancer treatment and prevention. Journal of Global Pharma Technology, vol. 1, pp. 4-18, 2009.

Phytoresources as potential therapeutic agents for cancer treatment and prevention. ADD To my list. Author(s): T. Vijaya | K.C. Maouli | S.D Rao. Population rise, inadequate supply of drugs, prohibitive cost of treatments, sideeffects of several allopathic drugs and development of resistance to currently used drugs for diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. In the present review, medicinal plants, the promising sources for biologically active compounds having anticancer properties, the goals of using them as sources of therapeutic agents and their role in the discovery of leads for the development of conventional drugs for the treatment of cancer are reviewed.