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RESEARCH ARTICLE

PLANTS AND PHYTOCHEMICALS AS POTENTIAL SOURCE OF ANTICANCER AGENTS

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Abstract

A large number of bioactive compounds exist in various species of plants .Different types of extracts from different parts of plants have been screened for their anticancer activity in- vitro and in –vivo test models. Novel anticancer agents are being sought from traditional medicines. At present many plant derived drugs (Vinca alkaloids-vincristine, vinblastine, vindesine; Taxol—paclitaxel,docetaxel) are in clinical use for treatment of various types of cancers. This review describes a number of plants and their products possessing anticancer activity.

INTRODUCTION

The term cancer, malignant neoplasm (neoplasm means new growth) and malignant tumor are synonyms. Cancer is a general term applied to a series of malignant diseases which may affect many parts of the body. This disease is characterized by a rapid and uncontrolled cell proliferation leading to abnormal growth or tumor. If abnormal growth is not arrested it may progress to death of the patient.[1] In 1940s, the antileukaemic properties of chemical warfare agent, nitrogen mustards are recognized , but these agents are highly toxic to a wide range of cells [2] . Initially, cancer drugs were discovered through the large scale testing of synthetic chemicals and natural products against rapidly proliferating animal tumors systems [3].Recent studies on tumor inhibiting compounds of plant origin have shown promising results. At present many chemotherapeutic agents from plant origin are in clinical use for the treatment of malignant diseases. Vinca alkaloids isolated from Catharanthus roseus, vincristine, vinblastine and vinorelbine are effective in the treatment of haematological malignancy, breast, germ cell, lung cancer, testicular, Hodgkin's disease, Kaposi's sarcoma and carcinoma of breast where as taxans (isolated from Western yew tree; Taxus brevifolia) have become leading agents in the treatment of ovarian, breast, head , neck and lung cancers [4]. Surgery, radiotherapy and chemotherapy are the options currently available for the treatment of cancer. Chemotherapeutic agents can provide temporary relief but cause serious side effects like bone marrow toxicity, neurotoxicity [4]etc. Surgery is also not possible in all cases. There is urgent need for effective and safe anticancer drugs. A large number of bioactive compounds exist in various plant species. Various plants/extracts have been screened for their anticancer properties in vitro and in vivo test models. Novel anticancer agents are being sought from traditional medicines. This review describes a number of plants and their products possessing anticancer activity.

Material and Methods-

Data Collection-

The data for the present review was collected from various Ayurvedic text and research articles. Most of the papers reviewed herein pertinent to herbal medicine research were published in internationally recognized, English, peer-reviewed journals. Some of the Medicinal Plants/Phytochemicals used in the prevention and treatment of cancer are-

Allium sativum (Alliaceae) - Administration of garlic bulb extract (250 mg/kg,po) 3times a week, effectively suppressed 4-Nitroquinoline-1- oxide induced tongue carcinogenesis in rats [5]. Oral administration of garlic in rats produced a significant reduction in number (50 %) and area (48%) of glutathione-s- transferase placental form positive foci compared with control animals [6]. Garlic oil incubated in human promyelocytic leukaemia cells, HL-60 at a concentration of 20µg/ml, produced a marked suppression of HL-60 proliferation [7]. Oil and water soluble allyl sulphur compounds from garlic have been found to possess antitumorigenic properties probably by suppression of cell division at G (2)/ M phase [8]. Cytotoxic and anti tumor activities are also reported after A .cepa.

Alstonia scholaris R. (Apocynaceae)- Keawpradub et al. reported anti cancer activity from this plant [9].

Amorphophallus konjac (Araceae) - Luo found that glucomannan isolated from A. konjac protected mice against chemically induced cancer [10].

Andrographis paniculata Burm. F. (Acanthaceae)- Andrographolide, the potential cancer therapeutic agent is isolated from A. paniculata [11].

Annoa triloba Linn (Annonaceae)- Acetogenins of this herb have been found to be active against lung and breast cancer [12].

Arachis hypogaea Linn (Fabaceae) - It is used to prevent cancer [13].

Aronia melanocarpa - Polyphenols and anthocyanins are isolated from this plant . Several investigators reported beneficial effects in the treatment of colorectal cancer and colon cancer from this plant extracts [14].

Asparagus racemosus Willd (Liliaceae)- It is useful in treating tumors [15]. Leung & Foster [16] reported that A. officinalis plant possess cancer preventive properties.

Astragalus gummifera Linn (Fabaceae)- It inhibits cancer cell growth [16] and is used in treating carcinogenesis.

Aloe vera L. Burm (Liliaceae) Aloe emodin , a hydroxyanthraquinone present in the leaves has a specific in vitro and in vivo antineuroactodermal tumor activity. Cytotoxic mechanism is due to induction of apoptosis[17]. Dried juice from the entire plant given to mice was active on carcinoma Ehrlich ascites and sarcoma-180 [18].

Bacopa monniera Linn (Scrophulariaceae) This plant possess anticancer activity [19].

Bambusa arundinacea Retz (Poaceae) B.arundinacea is reported for highest cell growth inhibition (81.9%)in Swiss albino mice inoculated with Ehrlich ascites carcinoma cells [20].

Bauhinia racemosa (Caesalpiniaceae) Methanolic extract of B. racemosa stem bark exhibited antitumor effect in Ehrlich ascites carcinoma bearing mice [21]. Antitumor activity from B. variegate plant has been reported by Rajkopoor et al [22].

Biophytum sensitivum Linn. D.C.(Oxalidaceae)- An alcoholic extract of B.sensitivum for antitumor activity could inhibit solid tumor development on mice induced with Dalton's lymphoma ascites cells and increase the life span of mice bearing Ehrlich ascites carcinoma tumors [23]. Edible fruits and berries served the source of novel anticancer agents.

Bleekeria vitensis - Widely used in Europe in the treatment of advanced breast cancer [24]. Elliptinium a derivative of ellipticine, isolated from B. vitensis Ac.sm is marketed in France for the treatment of breast cancer.

Brassica oleracea Linn (Brassicaceae)- Used to prevent lung, stomach, colorectal, breast and other cancers [25]. Several studies reported anticarcinogenic properties from B.oleracea [26].

Buchanania lanzan Spreng (Anacardiaceae)- Alcoholic extract of aerial parts showed anticancer activity [27].

Calotropis gigantean Linn (Asclepidaceae)- Kiuchif et al reported anticancer activity from this plant [28]. Another species of this plant C. procera also possess anticancer properties.

Camellia sinensis Linn (Theaceae) Used to prevent colon and gastric cancers [29]. It is also used to prevent skin cancer. Anticancer effect may be related to reduction of blood vessel growth in tumors.

Careya arborea Robx. (Lecythidaceae)- Bark extract significantly reduced the solid tumor volume induced by Dalton's lymphoma ascites cells [30].

Carmona retusa Vahl. (Ehretiaceae)- This plant has a high potential in fighting the growth and multiplication of cancer cells [31].

Catharanthus roseus Linn (Apocynaceae)- The alkaloids vinblastine, vincristine and vinorelbine isolated from this plant is used at present in chemotherapy of various cancers such as lymphocytic lymphoma, Hodgkin's disease, testicular carcinoma, choriocarcinoma, acute leukaemia, lymphosarcoma, lung cancer and Kaposi's sarcoma [4].

Chrysanthemum morifolum Ramat (Asteraceae)- This plant may reverse precancerous gastrointestinal lesions [32].

Cissampelos pareira Linn (Menispremaceae)-Antileukaemic, antitumor activity against human carcinoma of nasopharynx in cell culture have been demonstrated [33].

Clematis manshrica Linn (Ranunculaceae)- Sponins from the plant of China C.manshrica has obvious antitumor effects against various transplanted tumor in mice [34]. The embelin derivatives such as 1,4- benzoquinone derivative 5-o-ethyl- embelin are promising antimitotic and anticancer molecules [35]. Sesquiterpens that are 15- carbon isoprenoid compounds have therapeutic potential in decreasing the progression of cancer.

Cleome gynandra Linn (Cleomaceae)-Alcoholic extract of whole plant was found to have anticancer activity against human epidermal carcinoma of nasopharynx in tissue culture and hepatoma 129 in mouse [36].

Coleus forskholii Briq. (Lamiaceae)-It is useful in the treatment of cancer [37]. The active principle of C. forskholii is forskolin which increase cyclic AMP levels in culture medium of human prostate cancer cells and thus inhibit the growth.

Combretum coffrum Loefl (Combretaceae)- A number of anticancer compounds called combretastatins are isolated from the bark of this plant (Combretastatin CA-4) which bind to the protein tubulin. A number of mitotic inhibitors (combretastatin) disrupt tumor blood vessels by constricting blood supply to tumors. Combretastatin A-4 is active against colon, lung cancers and leukemia [38].

Crocus sativus Linn (Iridaceae) -This plant is also called saffron. There is data indicating effects of saffron extracts on tumor inhibition and retardation of tumor progression in vivo and in vitro. Abdullaev & Espinosa Aquirre [39] suggested potential use of saffron in cancer therapy and chemoprevention trials. Recently Gutheil et al [40] showed that crocetin (carotenoid) as an antitumor agent probably act by inhibiting nucleic acid synthesis and growth factor signalling and inducing apoptosis. Proapoptotic effect of C. sativus extracts in lung cancer derived cell line has been demonstrated.

Croton tiglium Linn (Euphorbiaceae)- Plant was found to have antileukaemic and antitumor activity [41]. Major constituent of C. tiglium seed oil (12-o-tetra decanoyl phorbol- 13 acetate) was evaluated in human promyelocytic leukaemia, prostate cancer with good results [42].

Curcuma longa Linn (Zingiberaceae)- used to manage colorectal cancer [43]. This herb may have bile stimulating, liver protectant, antioxidant and anticancer effects. The inhibitory effects of C. zedoaria (christm) on experimental pulmonary metastasis of B-16 melanoma cells were reported [44]. Administration of C. zedoaria (250& 500 mg/kg) for 6 weeks, starting from 2 weeks before tumor inoculation significantly reduced the number of metastatic surface nodules in the lung, resulted in an extended life. Therapeutic trials also conducted in pulmonary metastasis.

Cassia fistula Linn (Caesalpiniaceae)- Gupta et al reported anticancer properties from this plant [45]. C. tora plant extract is active against p388 lymphocytic leukemia in mice.

Caesalpina sappan Linn (Caesalpiniaceae)- Jeon et al. reported cytotoxic and anticancer properties of this plant [46].

Daphne genkwa Linn (Thymelaeaceae)- Kai et al. reported its antitumor activity [47].

Datura metal Linn (Solanaceae)-Various alkaloids from this plant have anticancer or antitumor activities. Leaves are having antitumor compound [48].

Dillenia pentagons Linn (Dilleniaceae)-Methanolic extract of stem bark of D. pentagon appears to be more active against Dalton's lymphoma [49].

Dysoxylum binectariferum Hook. F. (Meliaceae)- Flavopridol isolated from this plant possess tyrosine kinase activity and potent growth inhibitory activity against breast and lung carcinoma cell lines. It also showed broad spectrum in vivo activity either alone or in combination with other anticancer agents against a broad range of tumors such as leukemias, lymphomas and solid tumors [24].

Ginkgo biloba Linn (Ginkgoaceae)- Suzuki et al reported that G. biloba leaf extract possess anticancer activity [50].

Gloriosa superba Linn (Liliaceae)-Rhizome is reported to possess anticancer activity [51].

Glycine max Linn (Leguminosae)-Hakkak et al. demonstrated protective effect of G. max extract on experimentally induced breast cancer in rats [52].

Gynostemma pentaphyllum – It is reported to be beneficial in the treatment of cancer [25].

Heliotropium eichwaldi Steud (Boraginaceae)- Aqueous extract from H. eichwaldi and H. indicum leaves showed anticancer activity against Schwartz leukemia (ascites) at a dose of 200 mg/kg [53]. Ethanol extract of whole plant of H.sublatum Hochst. Ex D.C. exhibited anticancer activity against human epidermoid carcinoma nasopharynx in tissue culture as well as p-388 lymphocytic leukemia in mice.

Hemidesmus indicus R. (Asclepidaceae)- Kulkarni reported anticancer activity from this plant [54].

Hibiscus sabdariffa Linn (**Malvaceae**)-Hibiscus protocatechuic acid has inhibitory and inductive effect on tumor promotion in mouse skin and in human leukemia cells respectively [55].

Hippophae salicifolia D. Don (Elaeagnaceae)-Aqueous and alcoholic extracts of H. salicifolia bark were screened against fibrosarcoma in swiss mice and Yoshida (ascites) sarcoma in Wistar rats. Extracts showed significant inhibitory activity against mouse fibrosarcoma. Histological studies showed degeneration and necrosis of tumor cells in large proportions of the new growth. Alcoholic extract of the bark also showed inhibitory activity against Yoshida ascites sarcoma as evidenced by an increase in the survival period of experimental animals [56].

Holarrhena antidysenterica Roxb. (Apocynaceae) – Fruit extract (50% ethanolic) showed anticancer effect against human epidermoid carcinoma of nasopharynx in tissue culture.

Hygrophila auriculata Schum (Acanthaceae) – Syn Astercantha longifolia – Ahmad et al. reported antitumor activity from plant extract against chemically induced hepatocarcinogenesis in wistar rats. [57]

Hyptis suaveolens Linn (Labiateae) – Ethanolic extract 50% of H. suaveolens exhibited anticancer activity against p 388 lymphocytic leukemia in mice.[58]

Impatiens balsamina Linn (Balsaminaceae) – Fifty percent ethanolic extract of whole plant was active against human epidermoid carcinoma of nasopharynx in tissue culture. The activity was confirmed in the fractionated extract .[59]

Indigofera cassioides Rottl (Fabaceae) – The extract of I.mysorenses whole plant (except root) revealed anticancer activity against P 388 lymphocytic leukemia in mice. Activity was confirmed in the fractionated extract. Han reported anticancer, antitumor activity from the extract of I. tinctoria. Antitumor activity of the ethanolic extract of I. aspalathoides was established .[60]

Inula cuspidate (Asteraceae) – Fifty percent ethanolic extract showed anticancer activity against human epidermoid carcinoma of nasopharynx in tissue culture and P 388 lymphocytic leukemia in mice.[58] Rai & Acharya reported that I. racemosa Hook (Asteraceae) plant extract possess anticancer activity. [62]

Ixora undulate Linn (Rubiaceae)- Whole plant extract (50% ethanolic) showed anticancer activity against P 388 lymphocytic leukemia in mice.[59]

Jasminum dispersum Wall (Oleaceae) - Anticancer activity on human epidermoid carcinoma of nasopharynx in tissue culture was observed in the extract of J. dispersum [59] and J. officinale.

Jatropha glandulifera (Euphorbiaceae) - Ethanolic extract (50%) of aerial parts was found to be effective anticancer agent against human epidermoid carcinoma of nasopharynx in tissue culture and P 388 lymphocytic leukemia in mice.[58]

Juniperus squamata Linn (Cupressaceae) – J. indica showed anticancer activity against human epidermoid carcinoma of nasopharynx in tissue culture.[59]

Justicia Linn (Acanthaceae)- J. neesii exhibited anticancer activity against P 388 lymphocytic leukemia in mice.[58]

Kaempferia rotunda Linn. (Zingiberaceae) - The tubers of Indian crocus are widely used as a local application for tumors swellings and wounds. The tubers are antitumor.[63]

Kalanchoe pinnata Adans (Crassulaceae)- The 50% ethanolic extract of K. integra (whole plant) showed anticancer activity against human epidermoid carcinoma of nasopharynx in tissue culture.[64]

Lagerstroemia speciosa Linn.(Lythraceae) – Bark extract of this plant is efficient to counter cancer cells .[31]

Lannea cromandelica (Houtt) (Anacardiaceae) - Ethanolic extract of stem bark and leaf of L. cromandelica was found to be active against walker carcinosarcoma 256 in rats.[64]

Larrea divaricata – The plant extract is used to treat cancer. It also has the potential for anticarcinogenic activity. [65]

Lavandula angustifolia Linn. (Lamiaceae) – In vitro and animal studies have shown anticancer activity of L. angustifolia. Preventive effect on cancer cell multiplication has been demonstrated [66].

Lawsonia inermis Linn. (Lythraceae) – Ali and Grover reported antitumor activity from this plant [67].

Ledum groelandicum Rtez. Labrador tea – leaf twig extract showed anticancer activity [68].

Lepidagathis subarmata (Acanthaceae) – Whole plant extract was found to exert anticancer activity against human epidermoid carcinoma of nasopharynx in tissue culture. L.trinervis also showed anticancer activity against L-1210 lymphoid leukemia in mice [58].

Luffa cylindrica Linn. (Cucurbitaceae) - Aqueous extract of L. cylindrica seed revealed anticancer activity against ascites form of Schwartz leukemia in transplanted tumor at a dose of 8 and 4 mg/kg. Ethanolic extract of L. graveolens fruit showed anticancer activity against human epidermoid carcinoma of nasopharynx in tissue culture which was further confirmed in the fractionated extract [53].

Lyonia oralifolia Wall. (Ericaceae)- Ethanolic extract of L. oralifolia whole plant (excluding root) was active against walker carcinosarcoma 256 in rats. Anticancer activity was also confirmed in the fractionated fraction [64].

Mallotus slenanthus (Euphorbiaceae) - Ethanolic extract of M. slenanthus showed anticancer activity against P_{388} lymphocytic leukemia in mice [69].

Mamordica charantia Linn. (Cucurbitaceae)- Hot water extract was active on LEUK- L-1210. Weak activity was produced on LEUK – P-388 drug was also preincubated with tumor cell line in vitro [70].Treatment with MAP 30 (Mamordica protein of 30K DA) resulted in inhibition of cancer cell proliferation as well as inhibition of HER 2 gene in vitro. Treatment of the human breast cancer bearing SCID mice with MAP 30 at 10 µg/ injection EOD for 10 injections resulted in significant increase in survival with 20-25 % of the mice remaining free for 96 days [71].

Manilkara adans (Sapotaceae) - Ethanolic extract (50%) of M. hexandra whole plant exhibited anticancer activity against walker carcinosarcoma 256 in rats [69].

Marsdenia tenacissima Wight (Asclepiadaceae) – Plant was found to have cytotoxic and anticancer activity [72].

Michelia champak (Magnoliaceae) – M. kisopa 50% ethanolic extract (whole plant) was active against human epidermoid carcinoma of nasopharynx in tissue culture [58].

Moringa oleifera Lamk. (Moringaceae)- Ethanolic extract (50%) was active against human epidermoid carcinoma of nasopharynx in tissue culture and P 388 lymphocytic leukemia in mice [73].

Morinda citrifolia Linn. (Rubiaceae)- Whole plant extract showed cancer preventive effect on both clinical practice and laboratory animal models [74].

Nigella sativa Linn. (Ranunculaceae)- Studies reported inhibition of stomach tumors, carcinoma & Ehrlich ascites carcinoma after using N.sativa extract [66].

Ocimum sanctum Linn. (Lamiaceae) – Aruna & Sivaram krishan reported antitumor activity from O. sanctum extracts [75].

Olea europaea Linn. (Oleaceae) – It is used to prevent colorectal cancer & to treat breast cancer [13].

Oryza sativa Linn. (Poaceae) –It is used in the treatment of bowel cancer [76].

Oxcycocus macrocarpos – Plant juice and products can reduce number of breast cancer tumors, delays tumor development and slow down metastasis of lung cancer and lymph nodes [25].

Phyllanthus amarus Schum. (Euphorbiaceae)- Jeena et al. reported anticancer activity from this plant. P. emblica also exhibit anticancer activity [77].

Plantago ovate Forsk. (Plantaginaceae) – It is used to treat cancer [25].

Platycodon grandiflorum - Anticancer activity from this plant was proved and established [78].

Plumbago zeylanica Linn. (Plumbaginaceae) – Plumbagin isolated from this plant have anticancer and cytotoxic activity. Plumbagin administered intratumorally & orally at 2mg/kg decreased tumor growth by 70% and 60% respectively in rats with methylchloranthrene induce tumor [79].

Raphanus sativus Linn. (Brassicaceae) – Plant extracts showed antitumor activity. Synthetic agent roscovitine , an anticancer drug which is derived from natural product olomucine originally isolated from Raphanus sativus and is in Phase II clinical trial in Europe [24],[80].

Rhus succedanea (Anacardiaceae) - Ethanolic extract of leaves showed anticancer activity. Ethanolic extract of sap also possess anticancer activity [81].

Rubia cordifolia Linn. (Rubiaceae)- Mollungin isolated from R. cordifolia showed considerable activity against lymphoid leukemia P-388 in mice [82].

Semecarpus anacardium Linn. (Anacardiaceae) – Experimental studies on the anticancer activity of nut juice showed that oral administration to cancer patients particularly suffering from oesophageal and mouth cancer is beneficial in providing clinical improvement, symptomatic relief and survival time [83].

Sesbania grandiflora Linn. (Fabaceae)- Mackeen et al reported cytotoxic activity against HeLa (Human cervical carcinoma) cell line [84].

Solanum nigrum Linn (Solanaceae)- Steroidal glycosides (S-N-o, SN-2 & SN-3) showed inhibition of tumor cells of human uterus [85].

Strychnos nux vomica Linn (Loganiaceae)- Iso strychnine-N-oxide and isobrucineN-oxide showed the most potent cytotoxicity to tumor cell lines of K-562 Hela & HEP-2 [86].

Taxus brevifolia Linn (Taxaceae)- Taxol isolated from the shoot and bark of T. brevifolia showed potential as an anticancer agent, particularly in the treatment of ovarian cancer. Decoction of the leaves and branches has been used in the treatment of lung cancer [87]. Adachi et al reported that 10- decacetyl cephlomannie, 10-decacetyl taxol isolated from T.baccata were active against PS leukemia in vivo. Therapeutic evaluation was conducted using taxol. Taxol is one of the most important drug for treatment of ovarian, breast and lung cancer and melanoma. Docetaxol is used in the treatment of nonsmall cell lung cancer and also as a new treatment in breast cancer [88].

Tabebuia impetiginosa- Tebebuia species have a history of significant activity against a range of tumor cell lines, including breast, leukemia and prostate lines [24].

Terminalia paniculata Linn (Combretaceae)- stem bark extract possess anticancer activity [89].

Tinospora cordifolia Willd.(Menispermaceae)- Jagetia et al. reported antitumor , antineoplstic activity from this plant. [90]

Trigonella foenum graecum Linn (Fabaceae)- Das et al. reported anti tumor and antineoplastic activity from T.foenum seed extract [91].

Triticum aestrivum Linn (Gramineae)- Plant extracts used to prevent cancers of colon and breast [92].

Vaccinium Linn (Vacciniaceae)-Polyphenolic extracts from V. macrocarpon inhibited the growth and proliferation of breast, colon, prostate, lungs and other tumors as do flavonoids, proanthocyanidine, oligomers and triterpenoids isolated from the fruits of same plant [93]. Anthocyanin pigment from V. myrtillus can reduce risk of cancer [94]. Bomser et al demonstrated anticancer activity from the fruit extract of V.angustifolium [95].

Viscum albom Linn (Viscaceae)-Cazacu et al. reported anticancer activity in vitro and in vivo.[96]

Vitex agnus- castus (Verbenaceae)- Recently V. agnus castus fruit extract has been shown to possess anticancer activities in different human cancer cell lines (prostate epithelial cell line, DNA fragment assay, VACF treated cells). These data suggest inhibition of proliferation and induction of apoptosis in human prostate epithelial cell lines. Extract may be useful in human prostate cancer and BPH. Japanese scientists demonstrated cytotoxicity of vitex fruit extract (collected from Israel) against human uterine , cervical canal fibroblast , ovarian cancer(MCF-7), cervical carcinoma(SKG-3a), breast carcinoma(SKOV-3) gastric signet ring carcinoma KATO-III),colon carcinoma COLO-201) and small cell lung carcinoma LU-134-A-H) [97]. Imai et al [98] reported cytotoxicity of flavonoids from V.agnus castus (ethanol extract) against human colon cancer derived cell line and mechanism of flavonoid is due to apoptosis. Diaz et al reported cytotoxic and antitumor activity using V. negundo leaf extract [99].

Vitis vinifera Linn (Vitaceae)-Chen et al [100] reported tumor inhibitory and breast cancer suppressor activity from the V. vinifera plant extract.

Withania somnifera L. Dunal (Solanaceae)- Yadav et al. demonstrated anticancer activity of root stem and leaves of W. Somnifera against various human cancer cell lines [101]. Withaferin-A showed anticancer activity. Munagala et al reported that withaferin-A (WA) induces P53 dependent apoptosis by repression of HPV oncogenes and upregulation of tumor suppressor proteins in human cervical cancer cells. In vivo WA resulted in reduction of 70% of the tumor volume in athymic nude mice [102].

Yucca glauca--Plant extract has been shown to produce anti tumor activity against B-16 melanoma [66].

Miscellaneous plants having antitumor activity-

Azadirachta indica, Alangium salvifolium, Aerva lanata ,Alternanthera sessilis Abutilon indicum Abrus precatorius Albizia lebbeck , Baliospermum montanum Berberis aristata, Boswellia serrata,cynodon dactylon, Catum aregam, Cinnamomum verum,Curculigoar chioides,Caria papaya, Citrullus calocynthis,Embelia ribes,Hemides musindicus, Mallotus philippensis, Nelumbo nucifera, Nyctanthes arbortristis, Paederia foetida, Pongamia pinnata, Saraca asoca, Swertia chirayita and Syzygium aromaticum

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