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VARIOUS MEDICINAL PLANTS USED IN THE TREATMENT OF ANTICANCER ACTIVITY

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ABSTRACT: Cancer is a major public health burden in both developed and developing countries. It is actually a group of many related diseases that all have to do with cells. It is one of the major causes of death worldwide where the number of cancer patients is in continuous rise. It is a major public problem whose estimated worldwide new incidence is about 6 million cases per year. It is the second major cause of deaths after cardiovascular diseases. There is a constant demand for new therapies to treat and prevent this life-threatening disease. The plant kingdom produces naturally occurring secondary metabolites which are being investigated for their anticancer activities leading to the development of new clinical drugs. Worldwide effects are ongoing to identify new anticancer compounds from plants. In recent years owing to the fear of side effects people prefer more and more use of natural plant products for cancer. For these reasons, World Health Organization (WHO) supports the use of traditional medicines which are efficacious and non toxic. This review has tried to summarize few plants of India and out of India having anticancer activity.

INTRODUCTION: Our body is composed of many millions of tiny cells, each a self-contained living unit. Normal cells in the body grow and divide for a period of time and then stop growing and dividing. Thereafter, they only reproduce themselves as necessary to replace defective or dying cells. Cancer occurs when this cellular reproduction process goes out of control. The abnormal growth and division observed in cancer cells is caused by damage in these cells DNA (genetic material inside cells that determines cellular characteristics and functioning).

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There are a variety of ways that cellular DNA can become damaged and defective. For example, environmental factors (such as exposure to tobacco smoke) can initiate a chain of events that results in cellular DNA defects that lead to cancer.

Alternatively, defective DNA can be inherited from your parents. As cancer cells divide and replicate themselves, they often form into a clump of cancer cells known as a tumour. Tumour causes many of the symptoms of cancer by pressuring, crushing and destroying surrounding non-cancerous cells and tissues [1]. Treatment options, which depend on the stage and type of cancer, include: Surgery, Radiation therapy, Chemotherapy, Biological therapy, Hormone therapy *etc*. Despite substantial improvements in the current treatments that are available for patients diagnosed with cancer and the positive influence of these treatments on survival,

chemotherapy or radiation therapy cause an array of traumatic side effects, chemotherapy can sometimes cause unpleasant side effect like such as fatigue, sleep disturbance, appetite loss, hair loss, sore mouth, changes in taste, fever and infection, anxiety, depression, nausea, and vomiting. These side effects are often difficult to ameliorate or manage, and can significantly impair a cancer patient's quality of life (QOL). There are also chances of other harmful effects of these treatment *viz.* second cancers after chemotherapy, hormonal and reproductive problems, effects on the immunologic system, heart disease, effects on kidney and urinary bladder, effects on gastrointestinal organs, neurologic and psychological changes *etc*. [2, 3].

In recent years there has been a gradual revival of interest in the use of medicinal plants in the developing countries because herbal medicine have been reported safe and less or without any adverse effect especially when compared with synthetic drugs. Herbal medicines represent one of the most important fields of traditional medicines all over the world, to promote the use of herbal medicine and to determine their potential as a source of new drugs. It is essential to study medicinal plants which have folklore reputation in a more intensified way. Human beings have used the plants for medicinal purposes for centuries of the world including countries in the Indian sub-continent like India, Pakistan and Bangladesh [4].

The effort to find anticancer agents from higher plants was launched by the US National Cancer institute (NCI) in 1957. Today many of the most useful and curative anticancer drugs are derived from natural products. Since the initiation of program by NCI more than 35,000 plant species had investigated and resulted in the discovery of anticancer drugs such as Vincristine, Vinblastine, Taxol, Indicine - N - oxide, Etoposide analogs, Camptothecin and analogs *etc*.

India is the largest producer of medicinal plants and is rightly called the "Botanical garden of the World". The medicinal plants, besides having natural therapeutic values against various diseases, also provide high quality of food and raw materials for livelihood. Considerable works have been done on these plants to treat cancer, and some plant products have been marketed as anticancer drugs, based on the traditional uses and scientific reports. Medicinal plants have been stated [5] to comprise about 8000 species and account for approximately 50% of all the higher flowering plant species of India.

In other words, there are about 400 families of the flowering plants; at least 315 are represented by India. Medicinal properties of few such plants have been reported but a good number of plants still used by local folklore are yet to be explored. The Western use of such information has also come under increasing scrutiny and the national and indigenous rights on these resources have become acknowledged by most academic and industrial researchers. According to the World Health Organization (WHO), about three quarters of the world's population currently use herbs and other forms of traditional medicines to treat diseases. There are at least 250,000 species of plants out of which more than one thousand plants have been found to possess significant anticancer properties [6].

Advantages of Herbal Drugs over Allopathic Drugs: Medicinal plants still play a central role in the healthcare system of large proportions of the world's population. Recognition and development of the medicinal and economic benefits of plants are on the increase in both developing and industrialized nations. An herb (also called a botanical) is a plant or plant part used for its scent, flavor, and / or therapeutic properties. Products made from botanicals that are used to maintain or improve health have been called herbal supplements, botanicals, or phytomedicines. The pharmacological treatment of disease began long ago with the use of herbal medicines are "crude drugs of vegetable origin utilized for the treatment of disease states, often of a chronic nature, or to attain or maintain a condition of improved health".

It has been estimated that these medicines derived from plants constitute about 25 percent in modern pharmacopoeia. Traditional herbal medicines are naturally occurring plant-derived substances with minimal or no industrial processing that have been used to treat illness within local or regional healing practices. Common reasons for use of herbal drugs include health promotion, disease prevention, poor outcomes and limited treatment options for a serious illness, exhaustion of conventional

therapies, dissatisfaction with, or lack of efficacy of conventional therapies, significant side effects or risks associated with conventional medicine, belief that herbal and natural products are better or safer, preference for personal involvement in the decision making process, and cultural or spiritual preference. Whereas side effects of allopathic medications vary wildly from mild to severe and there are many. They include insomnia, vomiting, fatigue, dry mouth, diarrhea, constipation, dizziness, suicidal thoughts, hostility, depression, mania, seizures, coma, anemia, hair loss, high blood sugar, shoplifting, swelling, impotency, panic attacks, confusion, fainting and death. It is often difficult for seniors to keep track of multiple medications which further increase likelihood of side effects due to allopathic medicines [7].

Few types of plants species present are listed and detailed (active constituents, common names, part used, special character [if any]) below.

TABLE 1: PLANTS USED IN CANCER TREATMENT [8- 34]

S. no.	Botanical Names	Family	Active constituent
1	*Allium sativum*	Liliaceae	Alliin, allicin alliin, alliinase
2	*Actinidia chinensis*	Actinidiaceae	Polysaccharide known as "ACPS-R"
3	*Aloe ferox, Aloe barbadenis*	Liliaceae	Aloe-emodin, emodin, aloin
4	*Ananas comosus*	Bromeliaceae	Bromelain
5	*Angelica sinensis*	Umbelliferae	Polysaccharide fraction "AR-4"
6	*Annona species*	Annonaceae	Acetogenins
7	*Arctium lappa,*	Compositae	Potent anticancer factors
8	*Astragalus membranaceus*	Papilionaceae	Swainsonine
9	*Agapanthus africanus*	Agapanthaceae	Isoliquiritigenin
10	*Aglaila sylvestre*	Meliaceae	Silvesterol
11	*Betula utilis*	Betulaceae	Betulin
12	*Camellia sinensis*	Theaceae	Epigallocatechin gallate
13	*Catharanthus roseus*	Apocynaceae	Vinblastine, Vincristine
14	*Hedyotis diffusa*	Oocystaceae	Lysine
15	*Colchicum luteum*	Liliaceae	Colchicines demecolcine
16	*Combretum caffrum*	Combritaceae	Combretastatin
17	*Corcus sativus*	Iridaceae	Safranal, Crocetin, Crocin
18	*Echinacea angustifolia*	Asteraceae	Arabinogalactan
19	*Fagopyrum esculentum,*	Polygonaceae	Amygdalin, Rutin
20	*Ginkgo biloba*	Ginkoaceae	Ginkgolide-B, A, C and J
21	*Glycine max*	Leguminosae	Zinc, selenium, Vitamins (A, B1, B2, B12, C, D, E and K)
22	*Glycyrrhiza glabra*	Leguminosae	Glycyrrhizin
23	*Gossypium barbadense*	Malvaceae	Gossypol
24	*Gyrophora esculenta*	Umbilicariaceae	Polysaccharides β-glucans, α-glucans,
25	*Lentinus edodes*	Agaricaceae	Lentinan
26	*Linum usitatissimum*	Linaceae	Cynogenetic glycosides, Lignans
27	*Mentha species*	Labiateae	Monoterpene ketones
28	*Ochrosia elliptica*	Apocynaceae	Ellipticine and 9-methoxy ellipticine
29	*Panax ginseng*	Aralaceae	Ginsenosides, Panaxosides
30	*Picrorrhizia kurroa*	Scrophulariaceae	Picrosides I, II, III and kutkoside
31	*Podophyllum hexandrum*	Berberidaceae	Podophyllin,astragalin
32	*Taxus brevifolia*	Taxaceae	Taxanes, taxol cepholomannine
33	*Withania somnifera*	Solanaceae	Withanolides, Withaferin
34	*Zingiber officinale*	Zingiberaceae	Curcumin, gingerenone A, Gingeols, shogaols, zingerone
35	*Colchicum autumnale*	Liliaceae	Colchicine
36	*Betula alba*		Betulinic Acid
37	*Camptotheca acuminate*	Cornaceae	Camptothecia, Topotecan,CPT-11, 9-Aminocamptothecin
38	*Taxus baccata*	Taxaceae	Docetaxel, Taxol
39	*Cannabis sativa*		Delta-9-Tetrahydrocannabinol
40	*Tabebuia impetiginosa, T. avellanedae*	Cannabaceae	Beta-Lapachone, Lapachol
41	*Podophyllum peltatum*	Berberidaceae	Podophyllotoxin, Etoposide, Podophyllinic Acid, and Teniposide
42	*Nothapodytes foetida*	Icacinaceae	Acetylcamptothecin,

			Camptothecin, Scopolectin
43	*Heracleum persicum*	Apiaceae	-
44	*Gmelina asiatica*	Verbenaceae	-
45	*Adiantum venusutum*	Adiantaceae	-
46	*Anemopsis californica*	Saururaceae	cymene, limonene, piperitone and thymol
47	*Alangium salviifolium*	Alangiaceae	quercitin, kaemferol
48	*Acorus calamus*	Araceae	β-asarone (46.78%), linalool (0.41), farnesol (11.09%), methyleugenol (6.10%), α- and β-pinene (both 0.06%), [E]-caryophyllene (0.11%), β-elemene (0.39%), ocimene (0.7%), aromadendrene (0.26%), camphor (0.03%)
49	*Aspidosperma tomentosum*	Apocynaceae	-
50	*Antiaris Africana*	Moraceae	betulinic acid, 3β-acetoxy-1β,11α-dihydroxy-olean-12-ene, ursolic acid, oleanolic acid, strophanthidol, periplogenin, convallatoxin, strophanthidinic acid, methyl strophanthinate, and 3, 39-dimethoxy-49-O-β-d-xylopyronosyl ellagic acid
51	*Amoora rohituka*	Meliaceae	-
52	*Aegle marmelos*	Rutaceae	Butylp-tolyl sulfide, 6-methyl-4-chromanone and 5-methoxypsoralen
53	*Hibiscus mutabilis*	Malvaceae	-
54	*Arnebia nobilis*	Boraginaceae	Arnebin
55	*Aesculus hippocastanum*	Sapindaceae	β-escin
56	*Biophytum sensitivum*	Oxalidaceae	Amentoflavone, Isoorientin, Orientin, vitexin, epicatechin, 1, 2 dimethoxy benzene, linalool oxide, linalyl, acetate, isophorone
57	*Cuscuta reflexa*	Convolvulaceae	Kaempferol, uercitin, hydroxycinnamic acid, scoparone, melanettin, quercetin, hyperoside, cuscutalin, iso-rhamnetin-3-0-neohesperidoside, apigenin-7-0-rutinoside, lycopene, amarbelin
58	*Caesalpinia bonducella*	Caesalpiniaceae	Bonducin, Caesanol1, 6ß, 7ß dibenoyloxyvoiacapen-5-a-ol, Bonducellpins A, B, C, D
59	*Cassia fistula, Cassia tora, Cassia absus , Cassia auriculata , Cassia senna*	Fabaceae	Anthraqquinone, fistullic acid, rhein glucoside, phlobaphenes, emodin, chrysophanic acid, fistuacacidin, hexacosanol, obtusin, chryso-obtusin, obtusifolin, ononitol monohydrate, rubrofusarine, rubrofusarine triglucoside, non rubrofusarin gentiobioside ,panwar gum, chaksine, isochaksine, hydnocarpin, apigenin, raffinose, di-(2-ethyl) hexyl phthalate, sennoside A,B,C,D, palmidin A, rhein , aleo-emodin, myricyl alcohol, salicvlic acid, barbaloin
60	*Cleome gynandra*	Capparidaceae	Centaureidin, myricitin, taraxasterol, capric acid, lauric acid, glucocapparin, hexacosanol, viscosic acid, viscosin, glucoiberine, neoglucobrassicin, glucobrassicin
61	*Centella asiatica*	Apiaceae	Asiatic acid, madecassic acid, asiaticoside, asiatoside, madicassoside, brahminoside, brahmoside, centelloside
62	*Cola nitida*	Malvaceae	1,3,7-trimethyl-1H-purine-2,6(3H,7H)-dione, n-Hexadecanoic acid
63	*Cirsium japonicum*	Asteraceae	Cireneol G, ciryneol H, ciryneol C, p-coumaric acid, syringing, linarin, ciryneone F, ciryneol A
64	*Citrus medica*	Rutaceae	Methyl ferulic acid,dihydro-N-caffeoyltyramine, acacetin, ß-ecdysterone, (-)-balanophonin, p-methoxy cinammic acid, umbelliferone, ferulic acid, diosmetin, 4-methoxy salicylic acid
65	*Cissus quadrangularis*	Vitaceae	Iridoids, stilbenes
66	*Clerodendrum serratum , Clerodendrum viscosum*	Verbanaceae	Hispidulin, cleroflavone, apigenin, scutellarein, serratagenic, acteoside, verbascoside, clerodermic acid, clerodolone, clerodone, clerosterol
67	*Crinum asiaticum*	Amaryllidaceae	Criasiaticidine A, lycorine, pratorimine, crinamine, hippadine, hamayane, plaforinine, norgalanthamine, epinorgalanthamine
68	*Daucus carota*	Apiaceae	Carotene, carotin

69	*Embelia ribes*	Myrsinaceae	Embelin, christembine
70	*Jatropha curcas*	Euphorbiaceae	5α-stigmastane-3,6-dione, nobiletin, ß-sitosterol, taraxerol, jatropholone, jatropholone B, caniojane, daucosterol
71	*Kaempferia galangal* , *Kaempferia rotunda*	Zingiberaceae	Et-p-MeO-trans-cinnamate, crotepoxide
72	*Lanata camara*	Verbanaceae	Valecene, isocarypohyllene, bicyclogermacrene, germacrene D
73	*Lens culinaris medikus*	Fabaceae	-
74	*Limonia acidissima*	Rutaceae	Bergapten, orientin, vitedin, marmin, feronolide, feronone, feronialactone, geranyl umbelliferone, marmesin, ursolic, flavanone glycoside-7-O-methylporiol-4'-ß-xylopyranosyl-D-glucopyranoside
75	*Macrotyloma uniflorum*	Fabaceae	Psoralidin, agglutinin, pyroglutamylglutamine
76	*Mimosa pudica*	Mimosaceae	Mimosine, 2-mercaptoaniline
77	*Nicotiana tabacum*	Solanaceae	Rutin, chlorogenic acid, glutamic acid, anabasine, myosmine, cotinine, tabacinine, tabacine, anthalin, nicotelline, nicotianine
78	*Rhinacanthus nasuta*	Acanthaceae	Rhinacanthin, rhinacanthin-C, rhinacanthin-D.
79	*Zanthoxylum armatum*	Rutaceae	α-amyrin, armatonaphthyl arabinoside, 1-linoleo-2,3-diolein
80	*Xanthium strumarium*	Compositae	Spathulenol, α-cadinol, α-muurolene, copaene
81	*Salvadora persica*	Salvadoraceae	Salvadoricine, salvaoside, salvadoraside, manisic acid, salvadourea [1,3-bis(3-methoxy-benzyl)-urea]
82	*Symplocus cochinchinensis*	Symplocaceae	Phloretin-2-glucoside
83	*Vernonia cinerea*	Asteraceae	Luteolin-7mono-beta-D-glucopyranoside, lupeol acetate
84	*Vitex trifolia*	Verbanaceae	Artemetin, 7-desmethyl emetin, sabinene, α-pinene, caryophyllene, vitricin
85	*Solanum nigrum*	Solanaceae	Diosgenin
86	*Tinospora cardifolia*	Menispermaceae	COlumbin, tinosporaside, jatrorhizine, tembeterine, tinocordifolioside, tinosporic acid, tinosporal, tinosporon
87	*Momordica dioica*	Cucurbitaceae	Momordicin, momodicaursenol, gypsogenin
88	*Cynodon dactylon*	Poaceae	Ortho hydroxyphenyl acetic acid, syringic acxid, para coumaric acid
89	*Drosera indica*	Droseraceae	Rossoliside, hyperoside
90	*Barleria grandiflora*	Acanthacae	Iridoids, acetylbarlerin, scutellarein-7-rhamnosyl.
91	*Terminalia chebula*	Combretaceae	Arjunglucoside I, arjungenin, chebulosides I and II, chebulin, 2,4-chebulyl-ß-D-glucopyranose, chebulinic acid, chebulic acid, terchebin
92	*Cucurbita maxima*	Cucurbitaceae	Cucurbitacin, cucurbitin, pheophytin A, niacin, thiamine

CONCLUSION: Cancer is an abnormal malignant growth of body tissue or cell. A cancerous growth is called a malignant tumour or malignancy. A noncancerous growth is called benign tumour. The process of cancer metastasis is consisting of series of sequential interrelated steps, each of which is rate limiting. There are many traditional systems of medicine in the world, each with different associated philosophies and cultural origins.

Some of these, such as Tibetan traditional medicine, remain relatively localised in their country of origin; while others such as Ayurvedic and Chinese traditional medicines are increasingly used in many different areas of the world. Plants are loaded with chemical with chemo protective activities of some of them are undergoing clinical trial. Inhibition of angiogenesis is a novel process of cancer therapy. The selected and careful use of this plant may definitely in antiangiogenic therapy and thus in cancer management. Plant derived anticancer agents are effective inhibitors of cancer cells lines, making them in high demand. Exploitation of these agents needs to be managed to keep up with demands and be sustainable. A list has been tried to be created which can give idea of a huge variety of species of plants of the world which are commonly used or are under investigation for the effectiveness as anticancer.

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