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A Study of Natural Herbal Drugs for Cancer Chemoprevention

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Abstract – Cancer is the second leading cause of death in the world, following heart disease and respiratory disease. A long way still needs to be gone in the treatment and control of cancer progression, despite great strides being made. Chemotherapy can have a number of unfavourable side effects. Adverse side effects may be reduced with natural therapies like the use of plant-derived cancer treatment products. Several plant products are currently being investigated as potential cancer treatments. Although many plant products have shown promising anti-cancer properties in vitro, human trials are still pending for many of these compounds. The effectiveness of these plant products in treating human cancer will require additional research. There have been numerous plant-derived chemical compounds developed recently that have shown promise as anticancer agents, and their potential mechanisms of action will be discussed in detail in this review.

Key Words – Medicinal Plants, Natural Products, Ayurveda, Cancer, Alternative Medicine

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INTRODUCTION

Cancer is still one of the most common and deadly diseases in the world. Breast cancer is the most common non-communicable disease killer, followed by cardiovascular disease [1–4]. In the world, cancer is the leading cause of death, accounting for one in every eight people. North America, Australia, New Zealand, and Western Europe have higher rates of cancer incidence and mortality than the rest of the world [6, 7]. Cancer is responsible for one out of every four deaths in the United States [8]. Worldwide, cancer deaths are expected to rise from 7.1 million in 2002 to 11.5 million in 2030 [2].

On a regular basis, chemotherapy is employed in the fight against cancer. Oncogenic cells continue to divide despite the fact that normal cells have lost many of their regulatory functions. As a result of this property, cancer cells are more vulnerable to the effects of chemotherapy. A large number of useful chemotherapeutic agents has been discovered and developed over the course of approximately five decades of systematic drug discovery and development. Chemotherapy, on the other hand, is not without its drawbacks. Chemotherapeutic treatments can have a variety of side effects, including toxicities. The common chemotherapeutic agent 5-fluorouracil, for example, is known to cause myelotoxicity [9], cardiotoxicity [10], and even a vasospastic agent in rare but documented cases [11]. A common chemotherapeutic drug, doxorubicin can be toxic to the heart [12–14], kidneys [15], and the immune system [16]. Bleomycin is a well-known chemotherapeutic agent with a poor safety record because of the risk of developing lung cancer. Bleomycin has also been shown to be toxic to the skin [20]. It's known that the chemotherapy drug Cyclophosphamide, which is used to treat a variety of cancers, can have side effects on the bladder, such as hemorrhagic cystitis, immunosuppression, and alopecia, as well as cardiotoxicity at high doses.

Cancer patients who use allopathy or traditional medicine face challenges due to the toxicity of chemotherapy drugs. Oncology treatments have a long list of options, many of which use plant-derived ingredients. Vinca alkaloids, epipodophyllotoxins, taxanes, and camptothecin derivatives are the four main classes of plant-derived anticancer agents currently on the market: vinblastine, vincristine, and vindesine; vincristine; vindesine; and vincristine; (camptotecin and irinotecan). As a natural chemical repository, plants hold enormous potential for the development of new drugs, including those with chemoprotective properties against cancer. The Taneja and Qazi groups recently proposed a number of medicinal plant compounds with anti-cancer activity as potential targets.

MEDICINAL PLANTS AND CANCER

Plants have long been known to have anticancer properties. Drugs for treating testicular and small cell lung cancer were developed after podophyllotoxin and other lignans were isolated from the common mayapple (Podophyllum peltatum). A total of 35,000 plant species have been evaluated by the NCI for their potential anticancer properties. About 3,000 plant species have been found to have anticancer activity that can be replicated.

The chemoprotective properties of plants have been studied extensively, including the anticarcinogenic properties of Abrus precatorius on Yoshida sarcoma in rats and fibrosarcoma in mice and ascites tumour cells. The anticancer properties of Albizzia lebbeck on sarcoma in mice and Alstonia scholaries on benzo[a]pyrene-induced stomach carcinoma in humans were also studied by Dhar et al. Other plants that have shown anti-carcinogenic properties include Anacardium occidentale in hepatoma, Asparagus racemosa in human epidermoid carcinoma, Boswellia serrata in human epidermal carcinoma of the nasopharynx, Erthyrina suberosa in sarcoma, Euphorbia hirta in Freund virus leukaemia, Gynandropis pentaphylla in hepatoma, Ni

Some plants' anticancer properties are still being studied, and the results so far are encouraging. Some plants and plant products that have shown promise as anticancer agents are discussed in detail in the following sections.

1. Tinospora cordifolia (Wild) Miers

There are many names for Tinospora cordifolia, but the most common is guduchi (in Sanskrit), giloya (in Hindi), and the English name heartleaf moonseed plant (in English) (Fig. 1). The shrub's stem is the most commonly used part, but its roots are also known to contain significant amounts of alkaloids of interest. Indian, Myanmarese, Sri Lankan, and Chinese populations all have shrubs similar to this one.

Fig. (1) Tinospora cordifolia, also known as guduchi in Sanskrit, giloya in Hindi and heartleaf moonseed plant in English, under cultivation at experimental fields of IIIM, Jammu, India.

According to ancient Ayurvedic lexicons, *T. cordifolia* is also referred to as "*amrita"*. The term "*amrita"* is ascribed to this plant due to its ability to impart youthfulness, vitality and longevity. The stem of *T. cordifolia* is used for general debility, dyspepsia, fever, urinary disease, and jaundice. The extract of its stem is used in treating skin diseases. There are certain curative properties of the root of *T. cordifolia* which allow for its use as antidote in snake bite, in combination with other drugs.

2. Ziziphus nummularia Wight

Ziziphus nummularia, also known as bhukamtaka sukhsharanphala in Sanskrit, harbor in Hindi and wild jujube in English, is a thorny small bush or a divaricating shrub, with pale-purplish stems and or grey-velvety stipular prickles in pairs. Root, bark, stem, flowers, and seeds are all medicinally valuable parts of the plant. This shrub can be found in India, Pakistan, Afghanistan, Egypt, Iran, Iraq, and Israel, to name a few places.

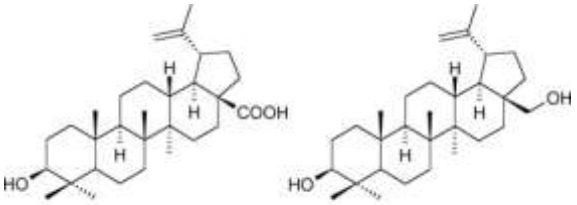
Z. nummularia's bark and stem contain antitumor compounds betulin and betulinic acid (chemical structures shown on the following page). Cancer cell lines are more sensitive to betulinic acid glycosides' differential cytotoxicity than normal cells. Tumor cell lines are sensitive to betulinic acid, an organic pentacyclic triterpenoid that occurs naturally. As a result of the production of reactive oxygen species, inhibition of topoisomerase I, activation of the mitogen-activated protein kinase (MAP) cascade, and inhibition of angiogenesis, betulinic acid has been shown to cause apoptosis and modulate the activity of transcriptional growth promoters and aminopeptidase N. Betulinic acid, on the other hand, has been shown to cause apoptosis without triggering p53 or CD95 expression. Betulinic acid's ability to effectively kill cancer cells that are resistant to other chemotherapeutic agents may be due to one or more of these mechanisms. A recent study found a synergistic effect of betulinic acid and anticancer drugs on mitochondrial membrane potential, as well as the release of cytochrome c and Smac from mitochondria. Caspases may be activated and apoptosis induced as a result of these changes. Notably, betulinic acid augments the anticarcinogenic effect of different cytotoxic compounds of different modes of action (for example, doxorubicin, cisplatin, taxol, or actinomycin D). Importantly, betulinic acid potentiates the apoptotic effect of anticancer drugs in different tumor cell lines, including *p53* mutant cells, as well as primary tumor cells, but not in human fibroblasts indicating some tumor specificity.

3. Andrographis paniculata (Burm. F.) Nees

Bhunimba and kalmegha in Sanskrit, kiryat in Hindi, and the king of bitters and chiretta in English

are all names for the same plant, Andrographis paniculata, which can be found in India and Sri Lanka (Fig. 2). The roots and leaves of the plant are the most commonly used medicinal components. Diterpenes, flavonoids, and stigmasterols are all present in the A. paniculata extract. Andrographolide, a diterpene found in Andrographis, is the primary medicinal component (chemical structure shown below). Because of its ring-like structure, andrographolide is referred to as a "diterpene lactone." It has a bitter taste and a colourless, crystalline appearance. Andrographis leaves contain the highest concentration of andrographolide (~ 2.25%), while the seeds contain the lowest.

Fig. (2) Andrographis paniculata commonly known as bhunimba and kalmegha in Sanskrit, kiryat in Hindi and the kreat king of bitters and chiretta in English, under cultivation at experimental fields of IIIM, Jammu, India.



A. paniculata is used in the treatment of wide variety of conditions such as jaundice, cholestasis and as an antidote for heptotoxins. It has also been shown to have anti-HIV properties. The immune system has been shown to be stimulated by A. paniculata in studies done on mice, and both antigen-specific and non-specific immune responses have been activated by it. A. paniculata is an effective chemoprotective agent against a wide range of infectious and cancer-causing agents because it activates both types of the immune response. Andrographolide has been shown to be toxic to a wide range of cancer cells when used topically. Examples include the cytotoxic effects of andrographolide on cancer cells such as KB human epidermoid, P388 lymphocytic, MCF-7 breast, and HCT-116 colon. There are also pro-differentiative effects of andrographolide on mouse myeloid leukaemia M1 cell line growth inhibition in the colon cancer cell line HT 29 and enhancement of human peripheral blood lymphocyte growth and division.

4. *Centella asiatica* Linn

Centella asiatica, known as mandukaparni in Sanskrit, brahmamanduki in Hindi and asiatic pennywort in English, is another plant that has shown potential as an anticancer agent. Plants of this genus can be found growing naturally in the tropics and subtropics of the world. Traditional medicine makes use of the whole plant or the leaves to treat various ailments. Some of the C. asiatica fractions used in the study inhibited the proliferation of transformed cell lines, including Ehrlich and Dalton's lymphoma ascites tumour cells, in a dose-dependent manner. Normal human lymphocytes, on the other hand, showed virtually no toxic effects. Cell proliferation in the mouse lung fibroblasts was significantly reduced in long-term culture with fractions of C. asiatica that had been purified to a high degree. Tumor-bearing mice received C. asiatica extracts orally, which slowed tumour growth and extended their lives. C. asiatica's antitumor activity may be due to a direct inhibition of DNA synthesis, according to the current thinking.

5. *Curcuma longa* Linn

Curcuma longa is popularly known as turmeric in English, haridra in Sanskrit and haldi in Hindi. The plant's rhizome is traditionally used in the kitchen as a spice (Fig. 3). Curcumin (diferuloylmethane, chemical structure below), a polyphenol derived from the plant's rhizome, is the active ingredient in turmeric. Turmeric is utilised in the treatment and prevention of cancer. Curcumin's anticancer properties are linked to its ability to slow the growth of a wide range of tumour cell types. Several genes, including NF-kappa B, Activator Protein 1, Epidermal Growth Receptor 1, cycloxygenase 2, lysyl oxidase, nitric oxide synthase, matrix metallopeptidase 9, and tumour necrosis factor, may be downregulated by curcumin's anti-proliferative properties (TNF). Turmeric also inhibits the expression of several chemokines, cell surface adhesion molecules, cyclins, and growth factor receptors, including the epidermal growth factor receptor (EGFR) and the human epidermal growth factor receptor 2 (HEGFR2) (HER2). Additionally, turmeric has been shown to inhibit the activity of cJun N-terminal kinase, as well as protein tyrosine kinases and serine/threonine kinases. By reducing MMP-2 activity and by inhibiting HEp2 (epidermoid carcinoma cell line) cell invasion, turmeric has been shown to inhibit tumour cell invasion and metastasis in vitro.

Fig. (3) Curcuma longa is popularly known as turmeric in English, haridra in Sanskrit and haldi in Hindi, under cultivation at experimental fields of IIIM, Jammu, India.

Many studies have shown that curcumin causes cell death and proliferation to slow down or stop altogether. On the other hand, Curcumin may exert its anti-proliferative and apoptotic effects by inhibiting the proteins that activate protein kinase C and protein tyrosine kinase, as well as by reducing the levels of the microRNA that expresses the tumour suppressor gene, which encodes B-cell lymphoma 2 (Bcl-2). It has been demonstrated that curcumin causes apoptosis in vitro through the rapid decrease in mitochondrial membrane potential, release of cytochrome c, activation of caspases 3 & 9 and downregulation of anti-apoptotic proteins Bcl-XL and IAP (IAP). Using LNCaP prostate cancer cells, researchers discovered that curcumin increased apoptosis by enhancing TRAIL, promoting cleavage of pro-caspases 3, 8, and 9, and causing the release of the antioxidant cytochrome c. According to new research, heat shock proteins may play a role in curcumin's ability to induce apoptosis in cancer cells.

6. *Phyllanthus amarus* Schumach. & Thonn

Phyllanthus amarus, also known as bhumyamalaki in Sanskrit, jaramla in Hindi, and stone breaker in English, is a tropical Asian plant native to warmer regions of the country. The entire plant, including the leaves, roots, and stems, are said to have medicinal value. Different lignans, flavanoids, and tannins are found in P. amarus, and research suggests that P. amarus extract has antitumor properties. Mice with Dalton's lymphoma ascites (DLA) and Erlich ascites carcinoma received oral administration of P. amarus extract, which extended their lives and reduced tumour size (EAC). Inhibition of carcinogenic compound metabolic activation, cell cycle arrest, and interference with DNA repair are all possible mechanisms by which this plant's chemoprotective properties may be explained

The incidence of n-nitrosodiethylamine (NDEA)-induced tumours was found to be significantly reduced when a plant extract from the P. amarus genus was used. In addition, tumor-marker enzymes and liver-damage markers have decreased, according to the research. Hepatitis B virus and related hepatitis viruses' DNA polymerase has been shown to be inhibited by P. amarus extract, and transcription and translation of hepatitis B virus mRNA are reduced as a result. Aniline hydroxylase, a P-450 enzyme responsible for the activation of carcinogens, was shown to be inhibited by P. amarus extract. cdc 25 tyrosine phosphatase, an important enzyme in cell cycle regulation, was inhibited by an extract of the plant P. amarus. In Sacchromyces cerviacae mutant cell cultures, an extract of P. amarus inhibited topoisomerase I and II activity. In mice with Lewis lung carcinoma, P. amarus extract had anti-angiogenic effects and interfered with the migration of vascular endothelial cells, according to the research.

7. *Annona atemoya* Mabb. / *Annona muricata* Linn

Annona atemoya/muricata is a native of Caribbean, Central and South America. The eastern part of India, particularly, is where it's most common. Mamaphal, the Hindi name for this plant, and sour-sop of America, the English name, both refer to the same thing. A plant's medicinal parts include the root, bark, leaf, and fruit. Root, bark, leaf, and fruit.

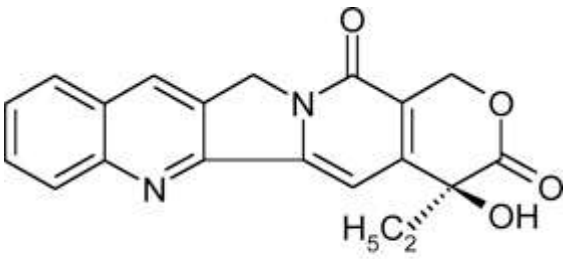
A. atemoya fruit contains bullatacin, an acetogenin with antitumor properties (see chemical structure below). Apoptosis occurs as a result of chromatin margination and tumour cell condensation caused by bullatacin. Two annomuricins, A and B, found in A. atemoya have been found to be cytotoxic to human solid tumour cell lines, including A-549 lung carcinoma, MCF-7 breast carcinoma, and HT-29 colon adenocarcinoma. Acetogenins found in the leaves of the plant are capable of selectively inducing cell death in cancer cells in the laboratory. The human hepatoma cell line HepG2 and the hepatoma 2.2.15 cells were found to be particularly sensitive to two annonaceous acetogenins that cause cell death.

8. *Mappia foetida* Miers. / *Nothapodytes foetida* Miers

Mappia foetida/ Nothapodytes foetida is generally found in tropical countries (Fig. 4). M. foetida's medicinal properties have recently come to the attention of researchers all over the world. Camptothecin, a potent chemotherapy drug used to treat leukaemia, is found in the wood of the M. foetida tree. According to new research, the camptothecine is produced by an endophytic fungus that lives on this plant. In vitro and in vivo, camptothecines exhibit a wide range of antitumor activity. Camptothecines, for instance, have been

shown in HeLa and L-120 cells to be effective inhibitors of nucleic acid synthesis. Several studies have linked camptothecine's anti-cancer properties to its ability to inhibit the nuclear enzyme type-1 DNA topoisomerase (NTI) (topo-1). In various stages of preclinical and clinical trials, these alkaloids, as well as several semi-synthetic or fully synthetic analogues, are being tested. Camptothecine is a new semi-synthetic camptothecine derivative that is active against ascites and solid tumours in mice and induces partial or complete remission in the xenograft model system of breast carcinoma. Camptothecines and their analogues have been tested for their anticancer properties in a number of Phase II clinical trials. The Phase II trials have revealed a wide range of anti-lymphoma, anti-leukemia, and anti-solid epithelial tumour activities. Human colon cancer cells, rhabdomyosarcoma cells, and osteogenic sarcoma xenografts grow more slowly when treated with topotecan, a synthetic modification of 10-hydroxycamptothecine.

Fig. (4) Mappia foetida under cultivation at experimental fields of IIIM, Jammu, India.



Camptothecine

9. *Withania somnifera* (Linn.) Dunal

Withania somnifera (Linn.) Dunal (Solanaceae) known as ashwagandha in Sanskrit and Hindi, winter cherry in English, is a small subtropical shrub (Fig. 5). When it comes to Ayurveda, the roots and leaves of W. somnifera have been used for thousands of years in Indian traditional medicine. The plant is sold all over the world for its medicinal properties. GRAS (generally recognised as safe) plants include this one, as it has been found to have multiple therapeutic uses. Many biological responses may be modulated by W. somnifera extract, according to the research. Due to its anti-aging, aphrodisiac, cardiotonic, thyro-regulating, anti-oxidative, anti-inflammatory, anti-tumor, anti-stress, anti-oxidant, immuno-modulatory, hemopoietic, and rejuvenating properties, it has been extensively used in many indigenous preparations.

Fig. (5) Withania somnifera known as ashwagandha in Sanskrit and Hindi, winter cherry in English under cultivation at experimental fields of IIIM, Jammu, India.

W. somnifera has been in use in the Indian traditional system of medicine for ages for its energy-promoting and anti-stress benefits. Withanolide A, a root constituent, has been found to have significant effects on the Th1 immune system, according to a recent study. Other chemicals found in W. somnifera include withaferin A, a compound that causes cancer cells to rapidly die when administered to them. However, the inability to synthesise or isolate therapeutic amounts of these withanolides from plants has severely limited their usefulness in clinics. An elite variety of W. somnifera's root and leaf extracts were mixed in the Indian Institute of Integrative Medicine in Jammu, India, to create a pharmaceutical composition rich in the active ingredients withanolide A and withaferin A [Indian Patent: 0202NF2006; Del 01321 dated 19-06-2007]. According to their current studies, the W. somnifera formulation appears to have a multi-modal effect on cancer disease. Several human cancer cell lines were tested, and the W. somnifera formulation caused cell cytotoxicity. As a result of increased production of ROS and NO in cancer cells, researchers believe that these compounds have mechanisms of cytotoxicity that include activation of intrinsic as well as extrinsic apoptotic signalling cascades. The high concentration of withaferin A in the W. somnifera formulation is thought to be a major contributor to the formulation's cell signalling pathways. The W. somnifera formulation increased the expression of apical death receptors in HL-60 cells and altered

the ratio of Bcl 2 family proteins, activating caspase-3 and PARP cleavage downstream, and causing nucleosomal DNA cleavage. This was followed by apoptosis. When compared to extracts prepared from the roots or leaves of W. somnifera, this formulation was effective in shrinking tumours in laboratory mice. While a comparable dose of W. somnifera formulation was highly effective in producing tumour regression by >50%, leaf extract at 150 mg/kg was highly toxic to mouse Sarcoma-180, Ehrlich and ascites tumour models. The root extract, on the other hand, was relatively poor in tumour regression. SRBC (sheep red blood cell)-challenged mice had higher levels of immunoglobulins and a DTH (delayed type hypersensitivity) response after receiving a daily oral dose of 10–100 mg/kg body weight of the mixed formulation of W. somnifera. After antigen challenge, it increased Th-1 cytokines like IL-2 and IFN-gamma, as well as the CD4+, CD8+, and CD3+ T cell populations, and activated peritoneal macrophage functions. It was found that Withanolide-A induced Th-1 immune polarisation corroborated this effect. In tumor-bearing mice, the W. somnifera formulation increased CD3 levels as well as IFN- and IL-2 expression levels. An interesting finding was that W. somnifera formulation, given to Ehrlich ascites tumor-bearing mice in progressively higher doses, markedly increased CD40+/CD40L+ expression in the tumour. To our surprise, this formulation activated the Th-1 type of immune response, which is critical in recognising cancer cells and intracellular pathogens, while also exhibiting strong anticancer activity, largely because of the withaferin A content.

10. *Cedrus deodara* (Roxb. Ex. D. Don) G. Don

It is native to the Himalayan foothills, eastern Afghanistan, northern Pakistan, northwest and northcentral India, southwestern Tibet, and western Nepal, where it is known as Cedrus deodara (deodar cedar). The drooping foliage makes it a popular ornamental tree for parks and large gardens. In modern Indian languages, the name "deodar" is derived from the Sanskrit name "devdar," which means "timber of the deities".

Using the bark of the Cedrus deodara tree can help with recurrent and intermittent fevers as well as inflammation, rheumatoid arthritis, and cancer. There is a lot of value placed on deodar oleo-resin as a remedy for skin ailments. There are a number of different uses for cedarwood oil, including expectorant, a catarrhal treatment for the respiratory tract and an anti-ulcer as well as for arthritis pain relief, anti-diabetic and skin diseases. Additionally, cedarwood oil can be found in a variety of fragrance products, including soaps, room sprays, floor polishes, and insecticides. Consumption of Cedrus deodara did not have any negative effects on the human body. Anti-obesity agents are made from tree resins. Additionally, it helps to clear the respiratory tract and alleviate the symptoms of a cold or the flu. When it comes to controlling the fungal deterioration of spices during storage, Cedrus deodara oil from India has shown some promise as an insecticide and antifungal. A panel of human cancer cell lines was cytotoxic to a lignan composition derived from Cedrus deodara's stem wood.

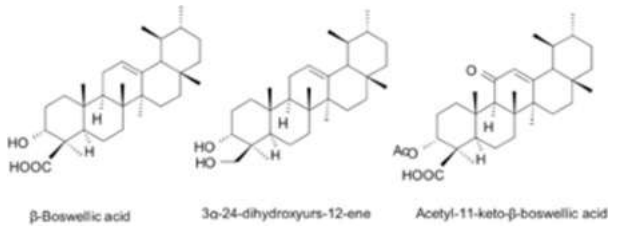
11. *Boswellia serrata* Roxb

Boswellia serrata is a deciduous middle sized tree, which is most commonly found in tropical parts of Asia and Africa (Fig. 6). The plant's gum is harvested by making incisions in the tree's trunk and storing it in specialised bamboo baskets, from which it is processed into various grades of material based on factors such as flavour, colour, shape, and size. Many of the gum's pharmacological properties have been discovered through research. Boswellia serrata's isomeric triterpenediol induces apoptosis in various cancer cells by mixing an isomeric mixture of 3, 24-dihydroxyurs-12-ene and 3, 24-dihydroxyolean-12-ene. As measured by various biological end points such as increased sub-G0 DNA fraction, DNA ladder formation and enhanced cell AnnexinV-FITC binding, it inhibited cell proliferation with an IC50 of 12 g/ml and produced apoptosis. In addition, early events involved high levels of ROS and NO formation, both of which were significantly reduced by their corresponding inhibitors.

Fig. (6) Boswellia serrata under cultivation at experimental fields of IIIM, Jammu, India

It was found that chronic exposure to high levels of NO and ROS resulted in Bcl-2 cleavage and translocation of the Bax protein to the mitochondria, causing a reduction in mitochondrial membrane potential (m) as well as release of various factors into the cytosol Survivin and ICAD (inhibitor of caspase activated DNAses) expression decreased in conjunction with the activation of caspases, resulting in PARP cleavage. The expression of cell death receptors DR4 and TNF-

R1 was also increased by triterpendiol, resulting in the activation of caspase-8. Triterpenediol causes oxidative stress in cancer cells, which leads to self-destruction through ROS and NO regulated activation of both the intrinsic and extrinsic signalling cascades, as shown by these studies. Chemical structures of the major chemical components of *B. serrata* are shown below.



CONCLUSION

Any practical solution to controlling the initiation and progression of cancer is of paramount importance. As an alternative to conventional allopathic medicine, medicinal plant products can be used to control or stop cancer-causing processes. To better understand their tumoricidal properties against various cancers, many herbs have undergone clinical trials. Molecular management of cancer physiopathology appears to be one of the emerging approaches, as well as cytotoxic approaches. It is the goal of these integrative approaches to control the cancer phenotype rather than simply eradicating the cancerous cells. In anticancer therapies, a number of plant-derived products have shown some promise. Single constituents isolated from natural products have been studied for their efficacy as chemopreventive agents. With that in mind, auyurveda, which takes a holistic approach to treating disease, may be a viable alternative to using individual plant isolates to treat cancer. Herbs are used in the ayurvedic medical system to treat a wide range of diseases and disorders. There is historical documentation of the use of plant products in the treatment of disease in the ancient texts Charaka Samhita and Sushruta Samhita. Two well-known Ayurvedic classics, the Charaka and Sushruta samhitas, describe cancer as an inflammatory or non-inflammatory swelling and refer to it as Granthi (a minor neoplasm) or Arbuda (a tumour) (major neoplasm). Some of T. cordifolia's medicinal properties include its ability to reduce inflammation and alleviate arthritis and allergy symptoms. T. cordifolia's anticancer properties have been demonstrated in vitro. The anti-oncogenic properties of A. Paniculuta extracts have been demonstrated [52–54].. Tumor-bearing mice received C. asiatica extracts orally, which slowed tumour growth and extended their lives. Tumeric also inhibits tumour cell invasion and metastasis in vitro, according to the study results. Mice with Dalton's lymphoma ascites (DLA) and Erlich ascites carcinoma received oral administration of P. amarus extract, which extended their lives and reduced tumour size (EAC). Plant products may have antitumor properties with few side effects, according to this research. New anticancer agents may be discovered through further study of plants and plant-derived chemicals.

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