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REVIEW ARTICLE **OPEN ACCESS**

"Exploring Nature's Arsenal: A Comprehensive Review of Anticancer Potential in Medicinal Plants and Marine Natural Compounds"

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ABSTRACT
The medicinal benefits of the amazing and diverse plant kingdom are widely recognised. Worldwide, a plethora of herbal remedies for a variety of ailments have been developed mostly due to the possible medicinal advantages of plant species. Due to the benefits of herbal treatment over allopathic medicine, medicinal plants are becoming more and more significant in the realms of health and medicine. One of the main health issues that has impacted people all over the world is cancer. Better and more potent medications than the ones currently in use are desperately needed to fight this illness. These days, many would rather utilise natural plant items to treat cancer. Notwithstanding the fact that medicinal plant drug development remains a significant source of novel therapeutic leads, a number of obstacles must be overcome, such as the selection and acquisition of plant materials. This article's goal is to assess the effectiveness of certain marine natural chemicals and medicinal plants in the treatment of cancer.
Keywords: *Medicinal plants, Cancer, Medication, Health, Marine natural compounds.*

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INTRODUCTION

Properly referred to as the "Botanical Garden of the World," India is the world's largest producer of medicinal plants [1]. It is believed that medicinal plants have a vast array of bioactive compounds with a variety of therapeutic uses. Plants' potential as medicines has long been well researched [2]. A minimum of 315 of the approximately 8000 species, or roughly 50% of all higher flowering plant species in India, are known to have medicinal properties. While the medical benefits of a small number of these plants have been proven, many more that are still used in traditional medicine have not yet undergone extensive research. The medical systems of Ayurveda, Siddha, and Unani provide a solid foundation for scientific investigation of physiologically significant molecules found in nature. The rediscovery of Ayurveda involves reframing it in relation to contemporary medicine. The new idea of fusing cutting-edge drug research programmes with Ayurveda is accepted worldwide. There is a long history of using traditional medicine to treat patients worldwide. A wealth of information is available for the study and creation of natural drugs from ethnobotany. The application of knowledge from traditional medicine to plant study has drawn a lot of attention recently. The rights of indigenous peoples to these resources are now acknowledged by most academic and commercial researchers, and the use of such material in the West has also come under closer scrutiny. [3] Medicinal herbs have a wide range of beneficial effects, such as analgesic, antiviral, anticancer, and anti-inflammatory [1]. The World Health Organization (WHO) estimates that over 75% of people on the planet today cure illnesses with herbs and other traditional medicines. In India, traditional remedies are commonly used. The last twenty years have seen a sharp rise in the use of plants and phytomedicines, even in the USA [4]. Furthermore, it has been reported that more than half of all medications that are currently prescribed are natural substances, many of which have been demonstrated to cause apoptosis in a range of cancer cells that originated from humans [5]. It is among the primary international obstacles to human health. Of all the pandemic diseases, cancer is the one that kills the most people. The changing lifestyle of the world's population is the main factor contributing to the increase in cancer cases globally. Statistics show that, accounting for about 23% of all cancer cases, breast cancer is the most frequent malignancy among women. Lung cancer accounts for 17% of all incidences of cancer in men, making it the

most frequent disease [2]. One of the leading causes of death worldwide, cancer affects more than one-third of the population and accounts for more than 20% of all fatalities. Cancer can be caused by a variety of substances, including tobacco, viruses, chemicals, radiation, environmental factors, and dietary variables [6]. In China, in addition to surgery, chemotherapy, and radiation therapy, complementary and alternative medicine is often utilised as the mainstay of traditional cancer treatment [7].

Medicinal herbs are the finest option when treating cancer

The chemical elements of medicinal plants possess primary antioxidant properties, which bolster their potential as anticancer medicines. Anthocyanins, coumarins, lignans, catechins, isocatechins, flavones, and isoflavones are the primary classes of bioactive compounds that have an antioxidant effect [8]. Certain compounds that are plant-based have certain negative consequences. These side effects can be controlled by using and administering them in a dosage-dependent manner, and this does not exclude their usage in phytochemical research. The currently accessible and expensive standard cancer therapies, such as chemotherapy and radiation, are linked with a number of adverse effects that can significantly lower quality of life, including myelosuppression and neurological, cardiac, pulmonary, and renal toxicity [9]. When an herb is given in combination with anticancer drugs, all aspects of pharmacokinetics might be affected, including absorption (resulting in altered absorption rate or oral bioavailability), distribution (mostly caused by protein-binding displacement), metabolism, and excretion [10,11]. Therefore, it is necessary to produce anticancer drugs that are safer and more effective than those that are now available for use as treatment options. 60% or more of anticancer drugs are derived from plants, according to industry data [12]. Medicinal plants are employed as a cancer treatment alternative in a number of countries worldwide [13]. To correlate their anticancer effects and expand their potential for drug development, many plants have undergone cytotoxic screening [14]. The use of plant-based medicines for cancer treatment is increasing worldwide, from 10% to 40%; in Asia, it has reached 50%, due to their potential benefits [15]. In order to develop more stronger drugs, the potential anticancer effects of natural plant derivatives require thorough clinical trials and scientific analysis.

Anticancer Plants

Black Cohosh (*Actaea racemosa*): This plant is mostly used for its cimicifugoside, cycloartenol-type triterpenoids, and derivatives of cinnamic acid. The herb is well known for treating a number of illnesses, such as amenorrhoea and chronic ovaritis [16]. Actein, one of this plant's active metabolites, has been demonstrated to have anticancer effects by preventing human breast and liver cancer cells from proliferating. Actein alters the expression of genes involved in the p53 pathway, fatty acid and cholesterol synthesis, CCND1, ID3, and ID3. Reduced liver levels of free fatty acids and cholesterol are the reason behind actein-induced reduction of human HepG2 liver cancer cells' growth[17].

Turmeric (*Curcuma longa*): The plant's therapeutic benefits have been demonstrated for a wide range of ailments, including rheumatism, sinusitis, cough, diabetic sores, biliary problems, anorexia, coryza, and cough[18]. Numerous pharmacological characteristics, including nematicidal, antioxidant, antibacterial, anti-inflammatory, and anti-HIV effects, are present in its plant. Its primary chemical constituent, curcumin, has a variety of biological impacts. The curcumin molecule also demonstrates anticancer potential by inhibiting several processes implicated in numerous stages of carcinogenesis [19].

Garlic (*Allium sativum*): It is applied to the treatment of fever, stomachaches, leprosy, earaches, and deafness. Its primary medicinal use is the treatment of cardiovascular disorders by reducing cholesterol and blood pressure. Additionally, it functions as a chemopreventive and antibacterial agent. The most significant anticancer component of old garlic extract is S-Allylmercaptocysteine. Numerous cell lines have been used to study thioallyl compounds, and the findings indicate that these compounds' antiproliferative effects are sensitive to those of both breast and prostate cell lines [20].

Coral Bush (*Ardisia crenata*): It has been widely used in traditional medicine to treat a wide range of illnesses, such as irregular menstruation, hepatitis, chronic bronchitis, and pulmonary tuberculosis. The chemical ardisiacrispin, a combination of two triterpenoid saponins called ardisiacrispins A and B, is responsible for its cytotoxic effects. Tests have demonstrated that the combination of triterpenoid saponins inhibits the unregulated proliferation of the Bel-7402 liver cancer cell line by causing reactions that break microtubules and promote apoptosis [21].

Liquorice (*Glycyrrhiza glabra*): It has been widely used in traditional medicine to treat a wide range of illnesses, such as irregular menstruation, hepatitis, chronic bronchitis, and pulmonary tuberculosis. The chemical ardisiacrispin, a combination of two triterpenoid saponins called ardisiacrispins A and B, is responsible for its cytotoxic effects. Tests have demonstrated that the combination of triterpenoid saponins inhibits the unregulated proliferation of the Bel-7402 liver cancer cell line by causing reactions that break microtubules and promote apoptosis [24].

Mango (*Mangifera indica*): It can be used to treat scurvy, bilious infections, blood diseases, gastrointestinal problems, and vitamin A deficiency, which causes night blindness. Diabetes has also been treated using

fresh mango leaves [25]. A recent study found that mango fruit contains lupeol, a triterpene that, in addition to its therapeutic benefits, has been demonstrated to have cytotoxic effects on skin cancer by inducing apoptosis in human epidermoid carcinoma A431 cells [26].

Ashwagandha (*Withania somnifera*): The adaptogen, aphrodisiac, anti-inflammatory, deobstruent, antibiotic, diuretic, narcotic, sedative, abortifacient, immune system-stimulating, astringent, and antioxidant properties of this plant are among its medical advantages [27]. Withaferin A, a chemical component of this medicinal plant, inhibits the growth of MDA-MB-231 xenografts and MCF-7 human breast cancer cells in vivo. This is associated with apoptosis induction, which is brought about by the suppression of mitochondrial respiration and facilitated by the production of reactive oxygen species. This provides a detailed explanation of the herb's anticancer properties [28].

Snake Jasmine (*Rhinacanthusnasutus*): The primary phytochemical components of this plant are rhinacanthone, naphthoquinone, lignan groups [29], and rhinacanthins (A–D, G–Q). Among other skin disorders, its active constituents may have pharmacological effects in the treatment of eczema, hepatitis, herpes, diabetes, hypertension, and pulmonary tuberculosis. Studies have indicated that rhinacanthins M, N, and Q and related naphthoquinone esters, along with synthetic chemicals, 1,2-naphthoquinones and 1,4-naphthoquinones, are antitumorous due to their capacity to selectively suppress the growth of KB, HeLa, and HepG2 human cancer cells as well as normal Vero cells. This gave the cells the chance to either repair the damage or undergo apoptosis [30].

Green tea (*Camellia sinensis*): Green tea's catechins, which are known for their antioxidant qualities, have been studied in connection to a number of diseases brought on by reactive oxygen species (ROS), including cancer [31]. It gives skin a radiant, healthy sheen, lessens inflammation, and delays the ageing process, whether consumed as a beverage or dietary supplement, or applied topically, green tea is an excellent skin protector.

It reduces inflammation and guards against direct cell damage. Green tea contains catechins, which are 20 times more potent antioxidants than vitamin E [32]. The remarkable antioxidant qualities of green tea are mostly attributed to polyphenols [33].

Bitter apple (*Solanum incanum*) : The primary chemical components of the plant, steroid glycosides, are known to provide defence against plant diseases and predators. Two steroid alkaloids that can be utilised to treat infectious illnesses and cutaneous mycotic infections are solanin and solasonine[34]. Another metabolite called solamargine has been demonstrated to have cytotoxic effect by killing normal skin fibroblasts [35].

Black cumin (*Nigella sativa*): Numerous chemical components have been identified through phytochemical studies, such as tannins, steryl glucoside, α-hedrin, nigellicine, nigellidine, nigellimine-N-oxide, thymoquinone, dithymoquinone, thymol, arvacrol, oxy-coumarin, 6-methoxycoumarin, and 7-hydroxycoumarin, as well as flavonoids, essential fatty acids, essential amino acids, ascorbic acid, iron, and calcium. Its numerous health advantages include the following: attributes such as analgesic, anti-inflammatory, antihistaminic, antioxidant, anticancer, immune-stimulating, antiasthmatic, antihypertensive, hypoglycemia, antiviral, antifungal, and antiparasitic [36]. The plant's secondary metabolite, thymoquinone, is deadly because it suppresses Akt activation, NF-κB, and extracellular signal-regulated kinase signaling—pathways that cause cancer cells to die. Additionally, it prevents tumour angiogenesis [37].

Rangoon Creeper (*Quisqualis indica*): This plant belongs to the family Combretaceae. The Latin expression "Which? What?" was developed by a Dutch botanist to define its unusual activity. Because of its exceptional reputation as a tropical vine—which distinguishes it from other species—and the colour of its blooms and foliage, Most people refer to it as "rangoon creeper." This shrub is extensively distributed globally and thrives in tropical settings, such as thickets and secondary forests in the Philippines [38]. The phytochemicals in Q. indica have been associated in preclinical settings with several cancers, including leukaemia, breast, colorectal, hepatic, prostate, and skin [39]

Kalmegh (*Andrographis paniculata*): It belongs to the Acanthaceae family and is a herbaceous plant. Its usual farming region is the Asian continent.It is sometimes referred to as the "king of bitters" or the "creat." Because of its blood-purifying qualities, it can be used to treat scabies, boils, skin eruptions, and chronic, inexplicable fevers. Andrographolide, an anti-inflammatory diterpenoid lactone with anticancer effects, is another ingredient found in the plant. Mitogen-activated protein kinases and apoptosis-related proteins are activated, which causes cell apoptosis and decreases IL-6-mediated signals and interleukin-6 (IL-6) expression. It is therefore an effective cytotoxic agent for liver cancer treatment [40].

Neem (*Azadirachta indica*): It has been used to treat cancers of the skin, breast, prostate, and stomach, as well as gastric and buccal carcinogenesis and B16 melanoma. Consumable neem blossoms significantly reduced the activities of several hepatic P450-dependent monooxygenases while increasing the liver's

glutathione S-transferase (GST) activity. These findings clearly suggest the potential benefit of neem blossoms as chemopreventive agents[41].

Chitrak (*Plumbago zeylanica*): It comes from Southeast Asia and is a part of the *Plumbaginaceae* family. Common names for it include "white leadwort," "Ceylon leadwort," "plumbago," and "chitrak." The plant's root contains a quinoid called plubagin, which has been demonstrated to have anticancer activity through possible impacts on the management of hormone-refractory invasive prostate cancer. Plumbagin causes cancer cells to undergo apoptosis and limits their development [42].

Prickly ash (*Zanthoxylum nitidum*): It belongs to the *Rutaceae* family and is widely distributed in Australia and Southeast Asia [43]. It has been shown that nitidine, a chemical component of the plant, has cytotoxic effects on LLC, which accounts for its potential to fight cancer. It is a DNA intercalator that is typically categorised as a topoisomerase I and II inhibitor. Cancer cells undergo apoptosis when these enzymes are blocked [44].

Natural Compounds in the Marine Environment

Psammaplin: It is an anticancer compound that was taken out of *Poecillastra spp. and Jaspis.* Its original isolation was caused by marine sponges called *Psammaplin aplysilla* [45]. It is a phenolic compound with a disulphide bridge that occurs naturally as monomers or dimers. Furthermore, psammaplin A contains a bromotyrosine ring [46]. This medication inhibits aminopeptidase N, a crucial component in angiogenesis and cancer cell invasion, and demonstrates antitumor effects [47].

Didemnin: The marine tunicate Tridemnum solidum yielded this cyclic depsipeptide. It was the first naturally occurring marine substance to be investigated as an anticancer agent in a clinical setting. Its structure is similar to the metabolites produced by cyanobacteria [48].

Dolastatin: In 1972, it was initially isolated from *Dolabella auricularia*, a type of sea hare. However, because of its low concentration, this drug's performance was extremely poor [49]. Trials using dolastatin have been conducted for the treatment of sarcoma, lymphoma, leukaemia, liver cancer, kidney cancer, and other conditions [50].

The advantages of employing anti-cancer marine natural chemicals and medicinal plants:

- Research has demonstrated that plant-derived chemicals can effectively destroy tumour cells while shielding healthy cells like lymphocytes and fibroblasts when combined with anticancer medications.
- Show a great deal of promise for cancer treatment.
- Because natural compounds are readily available and can be produced easily, the traditional use of natural substances in cancer treatment is comparatively inexpensive [51].
- Natural goods are frequently associated with safety by patients.
- In order to optimise herbal medical medicines for safe human use, scientific study is required [52,53].

CONCLUSION

The health of humans has greatly benefited by medicinal plants. The plant community has long been regarded as a crucial area for research and development as plant-based medications have such enormous potential to treat a wide range of disorders. The development of oncology, chemotherapy, and clinical practice has greatly profited from the introduction of plant-derived chemotherapeutic medicines. Chemotherapy is a crucial part of modern cancer treatment. With efforts to treat cancer and find a cure growing, the search for anticancer compounds in the plant kingdom has taken on greater significance. Plant extracts and the bioactive compounds included in them need to be screened for relevant information regarding their anticancer activity. There is a great deal of potential to discover new chemicals with anticancer effect due to the vast diversity of organisms found in the marine environment. This review can assist others in delving deeper into the study of herbs and marine natural substances, as well as their application in other toxicity and illness investigations and clinical trials.

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