



NATURE'S CANCER FIGHTERS: THIRTY-TWO POWERFUL PLANTS WITH PROMISING ANTICANCER POTENTIAL.

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ABSTRACT

This review article delves into the potential of thirty-two plant species as promising candidates for cancer treatment and prevention. Each plant species is examined individually, highlighting their bioactive compounds and mechanisms of action against cancer cells. The plants discussed include *Asparagus racemosus*, *Allium sativum*, *Astragalus gummifera*, *Bacopa monniera*, *Bleekeria vitensis*, *Arachis hypogaea*, *Aronia melanocarpa*, *Brassica oleracea*, *Camellia sinensis*, *Catharanthus roseus*, *Asparagus officinalis*, *Crocus sativus*, *Curcuma longa*, *Chrysanthemum morifolium*, *Coleus forskohlii*, *Datura metal*, *Ginkgo biloba*, *Gloriosa superba*, *Larrea divaricata*, *Lavandula angustifolia*, *Glycine max*, *Gynostemma pentaphyllum*, *Momordica charantia*, *Olea europaea*, *Rhus succedanea*, *Oryza sativa*, and *Terminalia paniculata*. *Yucca glauca*, *Triticum aestivum*, *Podophyllum peltatum*, *Trigonella foenum-graecum*, *Pyrus malus*. The review summarizes the research findings on these plants' anticancer properties, including their ability to inhibit cancer cell growth, induce apoptosis, suppress angiogenesis, and modulate immune responses. Additionally, their potential role in managing the side effects of conventional cancer treatments is explored.

KEYWORDS: Anti-cancer, apoptosis, angiogenesis, immune response, anticancer herbs.

INTRODUCTION

For a long time, plants have provided essential nutritional values, medicinal properties, and notable physiological effects to life, serving as a good source of food¹. Traditional medicine (TM) refers to the application, approach, knowledge, and belief in incorporating plant or animal-based properties in remedies, singularly or in combination, for the purpose of treating or preventing disease, as well as maintaining the well-being of an individual. Factors such as population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs, and the development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments².

Herbal remedies have been used to cure a variety of disorders or conditions such as diabetes, cardiovascular problems, weight control, dermal infirmities, sexual malfunction, and cancer, of course. According to the World Health Organization, more than 70% of the world's population uses TM to fulfill their health necessities³. The principles underlying herbal medicines are relatively simple, although they are quite distinct from conventional medicine and herbal medicine.

India is a rich source of medicinal plants, and a number of plant extracts are used against diseases in various systems of medicine, such as Ayurveda, Unani, and Siddha. However, only a few of them have been scientifically explored. Plant-derived natural products such as flavonoids, terpenes, and alkaloids have received

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considerable attention in recent years due to their diverse pharmacological properties, including cytotoxic and cancer chemopreventive effects ^{4,5,6,7}

The natural world has been providing lifesaving antibiotics, nutritive supplements, and our most potent anti-cancer drugs. The lush tropical rainforests and colorful coral reefs of our planet have long been a source of promise in the fight against cancer and other diseases. Natural products, especially those from plants, have been a valuable source of new cancer drugs for many decades. Medicinal plants are the most exclusive source of life-saving drugs for the majority of the world's population. The use of plant products in the treatment of cancer has recently gained interest⁸ In the market, these products are offered as "natural products". Cancer is the abnormal growth of cells in our body that can lead to death. Cancer cells usually invade and destroy normal cells. Despite the increasing amount of cancer research, we still do not fully understand what cancer is. Cancer is the second leading cause of death in America. The major causes of cancer include smoking, dietary imbalances, hormones, and chronic infections leading to chronic inflammation ⁹.

I. PLANTS USED IN CANCER PREVENTION AND TREATMENT:

1. *Asparagus racemosus*:

It is also known as Shatavari, holds promising potential in the realm of cancer treatment and prevention. Extensive research suggests that this herb exhibits anti-cancer properties due to its rich content of bioactive compounds. These compounds, including saponins, flavonoids, and steroidal glycosides, have been found to possess anti-inflammatory, antioxidant, and immune-enhancing effects, which are crucial in combating cancer¹⁰.

Studies have shown that *Asparagus racemosus* extracts can inhibit the growth and proliferation of cancer cells in various types of tumors, such as breast, ovarian, lung, and colon cancer. Additionally, it has been observed to induce apoptosis in cancer cells, which plays a crucial role in preventing tumor progression ^{11,12}.

Furthermore, Shatavari exhibits immunomodulatory effects by stimulating the immune system and enhancing the body's natural defense mechanisms against cancer. It helps in strengthening the immune response, reducing tumor-associated inflammation, and enhancing the activity of immune cells involved in recognizing and eliminating cancer cells ^{13,14}.

The herb's multifaceted benefits extend beyond its anti-cancer properties. It also aids in managing the side effects of conventional cancer treatments, such as chemotherapy and radiation therapy. *Asparagus racemosus* can help alleviate symptoms like fatigue, nausea, and gastrointestinal disturbances, thereby improving the overall quality of life for cancer patients ¹⁵

While more research is still needed to fully understand the mechanisms behind *Asparagus racemosus*' anticancer effects, its potential as a complementary or alternative therapy in cancer management holds great promise. It underscores the importance of exploring natural remedies like Shatavari in the ongoing pursuit of effective cancer treatments and prevention strategies.

2. *Allium sativum*:

Allium sativum, commonly known as garlic, has gained recognition for its potential anticancer properties, in addition to its diverse range of medicinal uses. While it is utilized for the treatment of cardiovascular atherosclerosis¹⁶, HIV¹⁷, drug-induced lipid disorders ¹⁸, and prevention of colds, flu, and tick bites, its role in cancer prevention and management is particularly noteworthy¹⁹.

Garlic has been found to exhibit activity against various types of cancer cells, including erythroleukemia ²⁰, breast cancer, and prostate cancer cells ²¹. Studies have shown that garlic contains bioactive compounds such as allicin, diallyl sulfide, and diallyl disulfide, which possess potent antioxidant and anti-inflammatory effects ²². These compounds have been observed to interfere with cancer cell growth, induce apoptosis ²³, inhibit angiogenesis (formation of new blood vessels to support tumor growth) ²⁴, and suppress metastasis (spread of cancer to other parts of the body)²⁵.

Furthermore, garlic's immune-enhancing properties contribute to its anticancer potential. It stimulates the immune system, enhances the activity of natural killer cells and other immune cells involved in recognizing and eliminating cancer cells, and modulates immune response to combat cancer progression.

The unique combination of garlic's bioactive compounds and its immunomodulatory effects make it a promising candidate in the realm of cancer prevention and treatment ²⁶. While more research is needed to fully understand the mechanisms of garlic's anticancer activity and its optimal usage, its inclusion as a part of a healthy diet and lifestyle holds potential in reducing cancer risk and improving overall well-being.

3. *Astragalus gummifera*:

Studies have shown that *Astragalus gummifera* contains bioactive compounds, including flavonoids, saponins, and polysaccharides, which contribute to its anti-cancer effects. These compounds exert various mechanisms of action, such as inducing cell cycle arrest, promoting apoptosis, inhibiting angiogenesis, and suppressing metastasis (spread of cancer to other parts of the body). By inhibiting cancer cell growth, *A. gummifera* plays a crucial role in impeding the progression and development of tumors. Its potential in treating carcinogenesis offers promising opportunities for therapeutic interventions in cancer management ²⁷.

4. *Bacopa monniera*:

Bacopa monniera, commonly known as Brahmi, is a versatile plant that offers a range of health benefits. In addition to its well-known ability to improve learning and cognitive abilities, *B. monniera* also possesses anticancer properties. Research has indicated that *B. monniera* exhibits potent anti-cancer effects against various types of cancer cells. It contains bioactive compounds, such as bacosides, which have shown anti-proliferative and apoptotic-inducing activities, effectively inhibiting the growth and spread of cancer cells. These anticancer properties make Brahmi a promising candidate for further investigation in cancer treatment and prevention ^{28,29}

5. *Bleekeria vitensis*:

Bleekeria vitensis, an herb with a noteworthy anticancer perspective, has gained recognition in Europe for its use in the treatment of advanced breast cancer. This indicates its potential as a complementary therapeutic option in managing this challenging condition.

6. *Arachis hypogaea*:

Arachis hypogaea, commonly known as peanut, has shown potential as an anticancer agent. Peanuts contain various bioactive compounds, including resveratrol, phytosterols, and flavonoids, which have demonstrated antioxidant and anti-inflammatory properties. It inhibits the growth and proliferation of cancer cells and reducing the risk of certain types of cancer, such as colon, prostate, and breast cancer ³⁰.

7. *Aronia melanocarpa*:

Polyphenols, carbohydrates, minerals, and vitamins are the primary *Aronia melanocarpa* components that are important for nutrition and health. Numerous in vitro and in vivo studies have shown that these compounds have a wide range of nutritional and physiological effects, including antioxidative, anti-inflammatory, hypotensive, antiviral, anticancer, antiplatelet, and antiatherosclerotic properties ³¹.

8. *Brassica oleracea*:

Brassica rapa, a highly diverse plant species found worldwide, exhibits remarkable potential in the field of cancer research. Various sub-species of *Brassica rapa* have been identified, each with distinct characteristics and properties. Different parts of the plant, such as the root and leaf, have demonstrated strong anticancer and antioxidant activities. Recent studies have shown that the metabolites derived from *B. rapa* possess potent anti-cancer properties against a wide range of cancer types, including ovary, colon, bladder, lung, prostate, breast, and others. The root and leaf components of different sub-species of *B. rapa* have been particularly effective in inhibiting the growth of cancer cells, highlighting their potential as natural remedies against cancer ³².

9. *Camellia sinensis*:

Camellia sinensis, commonly known as tea, derives its leaves that are globally consumed as the second most popular beverage. Tea comprises various chemical compounds, including polyphenols (particularly catechins), caffeine, theophylline, and L-theanine, among others. Notably, the polyphenolic compounds play a crucial role in conferring tea's notable antioxidant properties and potential for preventing cancer. Bladder cancer represents a prevalent form of malignancy, and its development and progression are believed to be influenced by dietary and

lifestyle factors. Epidemiological studies have demonstrated that regular tea consumption can serve as a preventive factor against bladder cancer^{33,34}.

10. *Catharanthus roseus*:

Catharanthus roseus, is commonly known as Madagascar periwinkle, exhibits promising anticancer properties. It contains various alkaloids, including vinblastine and vincristine, which have shown potent anticancer effects against different types of cancer. These alkaloids interfere with cancer cell division and inhibit tumor growth. *C. roseus* holds potential as a natural source of anticancer compounds and continues to be an area of interest in cancer research^{35,36}.

11. *Asparagus officinalis*:

Asparagus officinalis, commonly known as asparagus, has shown potential as an anticancer agent. It contains various bioactive compounds, including saponins, flavonoids, and antioxidants, which contribute to its anticancer properties. Studies have indicated that asparagus extracts may inhibit the growth of cancer cells and exhibit antioxidant and anti-inflammatory effects. Although further research is needed, asparagus holds promise as a natural source of compounds that may help in the prevention and treatment of cancer^{37,38}.

12. *Crocus sativus*:

Crocus sativus, is commonly known as saffron, exhibits potential as an anticancer agent. It contains bioactive compounds such as crocin and safranal, which have demonstrated anticancer properties in preclinical studies. These compounds have shown inhibitory effects on the growth and proliferation of cancer cells, as well as antioxidant and anti-inflammatory effects. While further research is required, saffron shows promise as a natural source of compounds that may have beneficial effects in cancer prevention and treatment^{39,40}.

13. *Curcuma longa*:

Curcuma longa, commonly known as turmeric, has strong potential as an anticancer agent. Its active compound, curcumin, exhibits powerful antioxidant and anti-inflammatory properties that have been linked to cancer prevention and treatment. Curcumin has shown the ability to inhibit tumor growth, induce apoptosis in cancer cells, and suppress the formation of new blood vessels that support tumor growth. While further research is needed, curcumin from turmeric holds promise as a natural and potent anticancer ingredient^{41,42}.

14. *Chrysanthemum morifolium*:

Chrysanthemum morifolium, commonly known as chrysanthemum, shows potential as an anticancer agent. It contains various bioactive compounds, including flavonoids and phenolic acids, which possess antioxidant and anti-inflammatory properties. Studies suggest that chrysanthemum extracts may inhibit the growth and proliferation of cancer cells and induce apoptosis. While further research is required, chrysanthemum holds promise as a natural source of compounds that may have beneficial effects in cancer prevention and treatment^{43,44}.

15. *Coleus forskohlii*:

Coleus forskohlii, also known as forskolin, has been studied for its potential as an anticancer agent. Forskolin, a bioactive compound found in *C. forskohlii*, has shown promising effects in inhibiting the growth and proliferation of cancer cells in preclinical studies. It is believed to exert its anticancer activity through various mechanisms, including modulation of signaling pathways and induction of apoptosis⁴⁵.

16. *Datura Metal*:

Datura metal, commonly known as Jimsonweed, has been investigated for its potential as an anticancer agent. Although limited studies have been conducted, extracts from *Datura metal* have shown cytotoxic effects against cancer cells in preclinical research. The plant contains various alkaloids, such as scopolamine and hyoscyamine, which may contribute to its anticancer activity^{46,47}.

17. *Ginkgo biloba*:

Ginkgo biloba, a popular herbal supplement, has been studied for its potential anticancer properties. Although it is primarily known for its cognitive benefits, certain components of *Ginkgo biloba*, such as flavonoids and terpenoids, exhibit antioxidant and anti-inflammatory properties that may have implications in cancer prevention and treatment. While some studies have suggested a potential inhibitory effect on cancer cell growth, more research is needed to fully understand the specific mechanisms and efficacy of *Ginkgo biloba* as an anticancer agent ^{48,49}.

18. *Gloriosa superba*:

Gloriosa superba, commonly known as flame lily or glory lily, has shown potential as an anticancer agent. The plant contains various bioactive compounds, including colchicine, which has demonstrated cytotoxic effects against cancer cells in preclinical studies. These compounds interfere with cell division and inhibit tumor growth ^{50,51}.

19. *Larrea divaricata*:

Larrea divaricata, commonly known as chaparral or creosote bush, has been studied for its potential anticancer properties. This plant contains various bioactive compounds, including nordihydroguaiaretic acid (NDGA), which has demonstrated promising effects against cancer cells. NDGA exhibits antioxidant and anti-inflammatory properties, and it has been shown to inhibit tumor growth and induce apoptosis in cancer cells ^{52,53}.

20. *Lavandula angustifolia*:

Lavandula angustifolia, commonly known as lavender, has shown potential as an anticancer agent. This plant contains bioactive compounds, including linalool and linalyl acetate, which possess antioxidant and anti-inflammatory properties. Studies have suggested that lavender extracts may inhibit the growth and proliferation of cancer cells and induce apoptosis ^{54,55}.

21. *Glycine max*:

Glycine max, commonly known as soybean, has been studied for its potential as an anticancer agent. It contains bioactive compounds such as isoflavones, including genistein and daidzein, which have shown promising effects in inhibiting the growth and proliferation of cancer cells. These compounds exhibit antioxidant and anti-inflammatory properties, and they may also interfere with cancer cell signaling pathways ^{56,57}.

22. *Gynostemma pentaphyllum*:

Gynostemma pentaphyllum, also known as Jiaogulan or Southern Ginseng, exhibits potential as an anticancer agent. It contains bioactive compounds called gypenosides, which have shown promising effects in inhibiting cancer cell growth and inducing apoptosis. These compounds also possess antioxidant and anti-inflammatory properties, making *G. pentaphyllum* a potential natural source for cancer prevention and treatment ^{58,59}.

23. *Mamordica charantia*:

Mamordica charantia, commonly known as bitter melon or bitter gourd, shows potential as an anticancer agent. It contains bioactive compounds such as charantin, vicine, and momordicosides, which have demonstrated anticancer effects in preclinical studies. These compounds have been found to inhibit cancer cell growth, induce apoptosis, and possess antioxidant and anti-inflammatory properties. Bitter melon holds promise as a natural source of compounds that may have beneficial effects in cancer prevention and treatment ^{60,61,62}.

24. *Olea europaea*:

Olea europaea, commonly known as olive, has shown potential as an anticancer agent. Olive extracts and its bioactive compounds, such as oleuropein and hydroxytyrosol, possess antioxidant and anti-inflammatory properties, which are believed to contribute to its anticancer effects. Studies have indicated that olive extracts can inhibit cancer cell growth, induce apoptosis, and suppress angiogenesis (formation of new blood vessels to support tumor growth). Olive products, particularly olive oil, are commonly included in Mediterranean diets, which have been associated with a reduced risk of cancer ^{63,64}.

25. *Rhus succedanea*:

Rhus succedanea, is commonly known as Japanese wax tree or lacquer tree, has shown potential as an anticancer agent. The plant contains bioactive compounds, including triterpenoids and flavonoids, which have demonstrated cytotoxic effects against cancer cells in preclinical studies. These compounds interfere with cell growth and division, induce apoptosis, and inhibit tumor growth ^{65,66}.

26. *Oryza sativa*:

Oryza sativa, commonly known as rice, has been studied for its potential anticancer properties. Although rice is primarily known as a staple food, certain compounds found in rice bran and rice germ have shown promising effects against cancer cells in preclinical studies. These compounds include antioxidants, phenolic compounds, and other bioactive substances that possess anti-inflammatory and chemopreventive properties ⁶⁷.

27. *Terminalia paniculata*:

Terminalia paniculata, also known as the flowering tree, has shown potential as an anticancer agent. It contains bioactive compounds, including tannins, flavonoids, and phenolic acids, which possess antioxidant and anti-inflammatory properties. It inhibiting the growth and proliferation of cancer cells and inducing apoptosis in various types of cancer, such as breast, lung, and colon cancer ^{68,69}.

28. *Yucca glauca*:

Yucca glauca, commonly known as soapweed or yucca, has shown potential as an anticancer agent. It contains bioactive compounds, including saponins and polyphenols, which possess antioxidant and anti-inflammatory properties. These compounds have been associated with inhibiting the growth and proliferation of cancer cells and inducing apoptosis in various types of cancer, such as breast, prostate, and colon cancer.

29. *Triticum aestivum*:

Triticum aestivum, commonly known as wheatgrass, has gained attention for its potential as an anticancer agent. It is rich in various bioactive compounds, including chlorophyll, antioxidants, vitamins, and minerals, which contribute to its health benefits. Wheatgrass has been studied for its potential to inhibit cancer cell growth, induce apoptosis (programmed cell death), and enhance the body's antioxidant defenses. It is believed to exert its anticancer effects through multiple mechanisms, such as reducing oxidative stress, modulating immune responses, and inhibiting angiogenesis ⁷⁰.

30. *Podophyllum peltatum*:

Podophyllum peltatum, commonly known as mayapple, has been studied for its potential as an anticancer agent. The plant contains bioactive compounds, such as podophyllotoxin, which have demonstrated cytotoxic effects against cancer cells. Podophyllotoxin is known for its ability to inhibit microtubule assembly, which is essential for cell division and proliferation. By interfering with this process, podophyllotoxin can effectively inhibit the growth of cancer cells. Additionally, research has shown that *P. peltatum* extracts possess antioxidant and anti-inflammatory properties, which can contribute to its potential anticancer activity. However, it is important to note that *P. peltatum* and its derivatives should only be used under medical supervision due to their toxicity and potential side effects.

31. *Trigonella foenum*:

Trigonella foenum commonly known as fenugreek, has shown promising potential as an anticancer agent. It contains bioactive compounds such as flavonoids, alkaloids, and saponins, which have demonstrated various anticancer properties. Fenugreek extracts have been found to inhibit the growth and proliferation of cancer cells in preclinical studies, particularly in breast, colon, prostate, and leukemia cancers. These effects are attributed to its ability to induce apoptosis (programmed cell death), inhibit angiogenesis (formation of new blood vessels), and suppress tumor cell invasion and metastasis. Additionally, fenugreek possesses antioxidant and anti-inflammatory properties, which contribute to its potential anticancer activity by reducing oxidative stress and inflammation associated with cancer development and progression ^{71,72}.

32. Pyrus malus:

Pyrus malus, commonly known as apple, has been investigated for its potential anticancer properties. Apples are rich in bioactive compounds, including flavonoids, polyphenols, and dietary fibers, which contribute to their health benefits. Studies have suggested that these compounds in apples possess antioxidant and anti-inflammatory effects, which can help reduce the risk of certain types of cancer. Additionally, apples contain quercetin, a flavonoid that has shown anticancer activity by inhibiting cancer cell proliferation, inducing apoptosis, and suppressing tumor growth. The high fiber content in apples may also contribute to their potential anticancer effects by promoting bowel regularity and reducing the risk of colorectal cancer^{73,74}

II. CONCLUSION:

In conclusion, the diverse array of natural plants and herbs discussed in this article, such as *Asparagus racemosus*, *Allium sativum*, *Curcuma longa*, and *Catharanthus roseus*, offer promising potential in the fight against cancer. These botanicals contain bioactive compounds with anti-inflammatory, antioxidant, and immune-enhancing properties that can inhibit the growth and proliferation of cancer cells, induce apoptosis, and strengthen the body's natural defense mechanisms. While further research is needed to fully understand their mechanisms and optimal usage, exploring natural remedies like these holds great promise in the ongoing pursuit of effective cancer treatments and prevention strategies. Harnessing the power of nature in conjunction with conventional therapies may provide new avenues for improving the quality of life and outcomes for cancer patients.

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