

Herbal Harmony: A Synopsis on Diverse Herbs and their Anticancer Attributes

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Globally, cancer is the primary cause of death, and its death toll is rising every day. Over the years, there is a long history of using medicinal plants to treat cancer, especially in India and the majority of developing nations. Toxic side effects are frequently a part of using synthetic medications to treat cancer. Therefore, the solution to the harmful side effects of synthetic drugs is to use medicinal plants, which are widely available and reasonably priced. The anticancer properties of twenty common medicinal plants found throughout India were compiled in this review. This review also covered the kind of cancer cell that was inhibited, the plant components that had anticancer properties, anticancer bioactive compounds, and the composition of the extracts utilized in the research. According to reports, the medicinal plants found in 21 India have anticancer properties for the ovary, breast, stomach, pancreas, kidney, skin, colon, esophagus, prostate, cervix, lung, and blood. The main groups including bioactive substances that have been linked to anticancer activity are Alkaloids, tannins, triterpenes, flavonoids, polyphenols, and quinones. Such plant-based substance exhibited major anticancer pharmacological actions, including apoptotic, cytotoxic, cytostatic, antimetastatic, antiproliferative, and antioxidative effects. Moreover, they caused cell cycle arrest, inhibited angiogenesis, additionally decreased viability and of cancer cells. Medicinal plants of India have the potential to yield affordable and easily accessible anticancer medications Later on, as plants included in this analysis demonstrated encouraging antitumor properties.

Keywords: Anticancer; Antiproliferative; Apoptotic Cytotoxic; India; Therapeutic plants.

Since the beginning of time, people have used plants to treat illnesses. Although the precise chemical makeup of medicinal plants is not always known, extensive usage and effectiveness reports have a significant influence on the disclosure of these plants' therapeutic potential, which results in their frequent prescription. Across the world, and particularly in South American nations, the utilization of therapeutic plants has greatly bolstered primary healthcare¹. People have been

searching for natural remedies to treat their illnesses since ancient times. Like with animals, the use of therapeutic herbs was initially instinctual. Everything was dependent on experience at the time because there was insufficient knowledge available about the causes of the illnesses or about the specific plant to use as a remedy². Herbal medicine has been used for medicinal purposes for as long as human civilization has developed with it. For millennia, traditional healers have utilized

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locally grown plants and herbs to treat a range of illnesses, and these have demonstrated evident pharmacological properties. Herbal medications have historically been used as powders, teas, tinctures, poultices, and formulations, then as pure substances³. India is home to an estimated 4.5 million different medicinal plant species, but only 250,000–500,000 of those have been the subject of phytochemical research for potential biological or pharmacological effects. Up to 80% of people worldwide still receive their primary care from traditional medicine, according to the World Health Organization (WHO)⁴. Using these natural medications and employing distinct treatment modalities, Ayurveda, a traditional Indian medical system, has been effective in preventing or suppressing a variety of tumors since ancient times⁵. The globe The word “environment” comes from the French word “environ.” I mean the environment. It encompasses everything external to the plant that either directly or indirectly affects its ability to survive. This is an essential component of the ecosystem on Earth. Environmental factors refer to all of the elements that make up the environment. Plants thrive in specific ranges of different parameters, such as soil and temperature⁶.

Cancer It is a collection of illnesses brought on by a in the cell cycle. Uncontrolled and abnormal cell growth is linked to cancer. Carcinogens are substances that alter the DNA and cause cancer⁷. Both external factors (tobacco, chemicals, radiation, and infectious organisms) can cause cancer. And internal variables (hormones, immune system disorders, inherited mutations, and mutations resulting from metabolism). The lack of widely available, comprehensive early detection techniques, the poor prognosis associated with late-stage diagnoses, and the disease’s rising global incidence all contribute to the fact that it is among the major global wellness concerns. Undoubtedly, among the largest problems facing humanity today is the fight against cancer⁵. Worldwide, cancer ranks as the second most typical cause of death. Every year, the World Health Organization’s data indicate that there are over 10 million new cancer cases diagnosed worldwide each year⁸. One of India’s leading causes of death is cancer, which affects 2.5 million people and adds 1 million new cases annually. By 2025, there’ll be a five-fold increase

in the disease’s mortality rate. The Indian Council of Medical Research (ICMR) has recommended that the Indian government make the disease of cancer reportable. In 1982, NCPDR, the National Cancer Registry Programme, was introduced by the Medical Research Council of India (ICMR), with the principal objective of generating precise data on the incidence and distribution of cancer in India⁹. The epidemiological transition, which has been aided by rising life expectancy, an aging population, and an increase in the prevalence of unhealthy lifestyles, has resulted in a recent global increase in cancer cases¹⁰. Even though a significant number of anticancer agents have been created from plants and the compounds derived from them, it is still difficult to create an anticancer medication that is affordable, safe, and site-specific⁸.

Information and data acquisition

Scientific databases like Mendeley, PubMed, SpringerLink, Medline, ScienceDirect, and Google Scholar provided the data and information utilized in this analysis. These Academic search engines were used to retrieve publications from 1972 to 2020, resulting in 61 sources mentioned in this report.

Some effective anticancer plants

This review focused on 20 common medicinal plants that are anticancer across all of India. Additionally, the kind of cancerous cell that was repressed, the botanical components that had anticancer properties, anti-tumor biologically active substances, and various kinds of extracts that were utilized in the research were listed in Table 1 and summarized.

***Aloe barbadensis* (Asphodelaceae)**

Mice treated with an ethanol extract of *Aloe vera* (*Aloe barbadensis*) showed anticancer activity by stimulating the antioxidant defense system and modulating lipid peroxidation. Additionally, reports have indicated that *A. barbadensis* is cytotoxic to HepG2 and HCC cancer cell lines¹¹. The most advocated benefit of aloe vera for a cancer patient is its alleged ability to prevent and treat skin lesions caused by radiotherapy¹².

Clinical significance

Aloe barbadensis, commonly known as aloe vera, is a member of the Asphodelaceae family and has anti-inflammatory and wound-healing properties. As such, it is useful in dermatology for

skin conditions like eczema, burns, and wounds. It is also used to prevent gum disease, treat digestive disorders such as IBS, and reduce oxidative stress¹³.

Allium sativum (Amaryllidaceae)

Together with carbs, proteins, and fiber, fresh garlic also contains a variety of organosulfur compounds, trace amounts, and chemicals with phenolic and steroidal origins. Two groups of the contents are separated based on how soluble they are. Two groups of allyl sulfur compounds exist: The group of compounds known as S-allylmercaptocysteine (SAMC) and S-glutamyl S-allylcysteine (SAC) is soluble in water, and the compounds diallyl trisulfide (DATS) and diallyl disulfide (DADS) are soluble in lipids¹⁴. Radical scavenging action was demonstrated by aged garlic extract but not by fresh garlic extract¹⁵.

Clinical significance

Due to its many medicinal properties, *Allium sativum*, commonly known as garlic, has significant clinical implications. It is well known for having antimicrobial, anti-inflammatory, antioxidant, and cardiovascular qualities. Traditional uses of garlic include lowering blood pressure, cholesterol, and the risk of cardiovascular disease. It may also fortify the immune system and have anti-cancer properties. But it's important to emphasize that more study is needed to fully comprehend its therapeutic implications and dose recommendations for specific medical conditions¹⁶.

Azadirachta indica (Meliaceae)

Indica leaf and seed extracts caused cancer cells to undergo autophagy and apoptosis, which in turn prevented the cancer cells from proliferating. The suppression of *A. indica* achieved and maintained cancer cell growth by obstructing the cell cycle's progression^{11,17}. Extracts from *A. indica*'s leaves and seeds induced the process of programmed cell death in stomach, prostate, colon, breast, cervical, hepatocarcinoma, and choriocarcinoma cancers^{18,19}. The primary groups of bioactive substances that give *A. indica* its anticancer properties are terpenoids, limonoids, flavonoids, and phenolics. *A. indica* Leaf extract in ethanolic form slowed the in vitro proliferating prostatic cancerous cells PC-3M-luc2 and C4-2B¹⁹.

Clinical significance

Azadirachta indica, commonly referred to as neem, has many therapeutic properties that make it clinically significant. In conventional

medicine, it is used to treat gastrointestinal issues, tooth problems, inflammation, and skin conditions. Due to its antimicrobial, antiviral, antifungal, anti-inflammatory, and antioxidant properties, neem is used in modern medicine to treat conditions like diabetes, eczema, acne, and malaria. Its possible anti-cancer properties are also being investigated. To fully understand its therapeutic significance and potential uses, more research is necessary²⁰.

Carica papaya (Caricaceae)

It has been documented that *C. papaya* leaf extracts are effective in treating prostate cancer²¹. It is thought that a few bioactive substances that have been separated from the *Carica papaya* leaves are probably what give them their anticancer properties. These bioactive substances include luteolin-Beta-D-glucopyranoside, luteolin, lycopene, papain, Linopeene, fisetin, morin, and cystatin, ben-zylisothiocyanate, quercetin, kaempferol, tetrahydroxyflavone, and myricetin-3-O-rhamnoside²².

Clinical significance

Because it contains the digestive enzyme papain, which helps with gastrointestinal disorders and improves digestion, *carica papaya*, also referred to as papaya, has clinical significance. Its anti-inflammatory properties may help conditions like arthritis, and its high antioxidant content enhances immunological response and wound healing. In addition, papaya is a powerful ingredient in skincare products because of its skin-renewing properties²³.

Curcuma longa (Zingiberaceae)

Curcuma longa Linn (CL), commonly referred to as "Haldi" in Hindi, is a spice and medicinal plant from India that is a member of the Zingiberaceae family. It is widely used in Ayurvedic, Unani, and Siddha medicine as well as as a home remedy for a variety of illnesses. Curcumin, a polyphenol, is the active ingredient in turmeric and is what gives it its yellow color. It also contains volatile oils like zingiberone, atantone, and tumerone. The current study assessed the 50% ethanolic extract of CL rhizomes' in vitro cytotoxic activity against the normal Vero epithelial both MB-231 MDA and the human breast cancer cell line. CL ethanolic extract's anticancer potential was assessed by cytometer-based analysis and the MTT assay. The Trypan blue dye exclusion method was used to calculate the cell lines' viability %²⁴.

Clinical significance

Owing to its potent anti-inflammatory, antioxidant, and antibacterial qualities, *curcuma longa*, better known as turmeric, has significant therapeutic uses. The potential therapeutic benefits of this substance have been thoroughly investigated in relation to conditions like arthritis, cancer, cardiovascular disease, neurological disorders, and gastrointestinal problems. In addition, curcumin, the primary ingredient, has shown promise in modifying a variety of signaling pathways connected to inflammation and the advancement of illness. To completely grasp its therapeutic utility and optimize its use in healthcare settings, more research is necessary²⁵.

Punica granatum (Lythraceae)

Pomegranates have been demonstrated to have anticancer properties, making them a significant source of bioactive properties. Pomegranates are rich in ellagitannins, anthocyanins, and hydrolysable tannins, and

they also have strong antioxidant properties. (26) Tannin and polyphenolics make up the majority of the ingredients in pomegranates. Pomegranate peels have been found to contain active inhibitors such as flavonoids and phenolics, according to phytochemical analyses²⁷.

Clinical significance

Punica granatum, sometimes known as pomegranates, has several health advantages, such as supporting gut health, wound healing, cardioprotection, antibacterial activity, and anti-inflammatory properties. Clinical significance is conferred by these attributes. Enhancing overall health and potentially preventing or treating various illnesses seem to be among its promising uses²⁸.

Citrus aurantifolia (Rutaceae)

The primary uses of Rutaceae, the family of *Citrus aurantifolia*, include, on a daily basis, numerous ethnic foods as well as juice



Fig. 1. *Aloe barbadensis* (Asphodelaceae)



Fig. 2. *Allium sativum* (Amaryllidaceae)



Fig. 3. *Azadirachta indica* (Meliaceae)



Fig. 4. *Carica papaya* (Caricaceae)

manufacturing. It is well-liked because of its antioxidant, antimicrobial, antitumor, insulin-producing, antifungal, contraceptive, counter-inflammatory, and anti-lipidemia characteristics. In addition, it shields the bile, heart, and bones, as well as guarding against kidney problems. Among its subsequent breakdown products are amino-alkaloids, carotenes, comarins, flavonoids, phenolic acids, and triterpenes. Among its additional significant components like rutin, Apigin, Hesperetino, Kampferol, tetranortriterpenoids, quercetin-3-O-rutinoside, 2, 3-dihydro-5, 7-dihydroxy-2-(4 hydroxyphenyl)-4 H-1-benzopyran-4-one, and hexamethoxyflavone, they all contribute to its medicinal qualities²⁹.

Clinical significance

Citrus aurantifolia, the key lime, has properties that make it clinically significant. These include antibacterial, digestive, skin, weight management, and possibly even cancer prevention. To fully understand its therapeutic applications,

however, more research is necessary. Before taking anything internally, it is usually best to consult a healthcare professional³⁰.

Mangifera indica (Anacardiaceae)

The large, long-living mango (*Mangifera indica* L.) sapling is a component of the Anacardiaceae family of evergreens. It has pharmacological characteristics such as antioxidant, antidiabetic, anti-tumor, and anti-inflammatory qualities. 21 At 200 µg/ml, mango leaf extract demonstrated cytotoxicity against every cancer cell line tested. The percentage of tested cancer cells that survived was unaffected by mangiferin. In this study, comparable cell lines were Wi-38 and CCD, two types of normal skin and lung fibroblasts; doxorubicin was employed as a positive control³¹.

Clinical significance

Mangifera indica, or mango, has gained therapeutic significance due to its anti-inflammatory and antioxidant properties, as well as its potential benefits for digestive and cardiovascular health,



Fig. 5. *Curcuma longa* (Zingiberaceae)



Fig. 6. *Punica granatum* (Lythraceae)



Fig. 7. *Citrus aurantifolia* (Rutaceae)



Fig. 8. *Mangifera indica* (Anacardiaceae)

immune-boosting capacity, favorable effects on skin health, and potential cancer-preventive features. Further research is required to fully understand its therapeutic potential and identify the most effective way to use it in clinical settings³².

***Zingiber officinale* (Zingiberaceae)**

Zingiber officinale, also known as ginger and a member of the *Zingiberaceae* family, is a rhizomatous perennial plant that has long been utilized as a treatment for conditions relating to the digestive system, including dyspepsia, nausea, vomiting, gastritis, and diarrhea. It has also been used to treat conditions related to the common cold, asthma, nervous system disorders, inflammation, hepatotoxicity, diabetes, migraine, hypercholesterolemia, helminthiasis, and schistosomiasis³³. *Z. officinale* contains the antitumor biological active substances 10-shogaol, Zingerone, Shogaol, Enexasogaol, and six-gingerol. The PC-3 phallus cancer cell line was unable to proliferate due to these bioactive compounds³⁴.

Clinical significance

The plant known as ginger, *Zingiber officinale*, has several therapeutic uses, including



Fig. 9. *Zingiber officinale* (*Zingiberaceae*)

anti-inflammatory, digestive, anti-nausea, pain-relieving, antibacterial, cardiovascular, and antioxidant properties. It might aid in advancing wellness and general health. Anxiety, nausea, digestive issues, arthritis, and discomfort have all been traditionally treated with it. Consult your healthcare provider before using ginger for therapeutic purposes, particularly if you are taking medication or have any underlying medical conditions³⁵.

Piper betel (Piperaceae)

In Indian traditional medicine, *piper betel*, or betel leaves, are used for their digestive and pancreatic lipase-stimulating properties³⁶. Herbal remedies have traditionally used the leaves of the Piper betel. Phenolic compounds that are active include hydroxychavicol, piperol, chavibetol, and piperbeto. Eugenol is abundant in betel leaves; eugenol is the primary phenolic compound with exceptional chemotherapeutic and



Fig. 10. *Piper betel* (*Piperaceae*)



Fig. 11. *Ocimum Sanctum* (*Labiatae*)

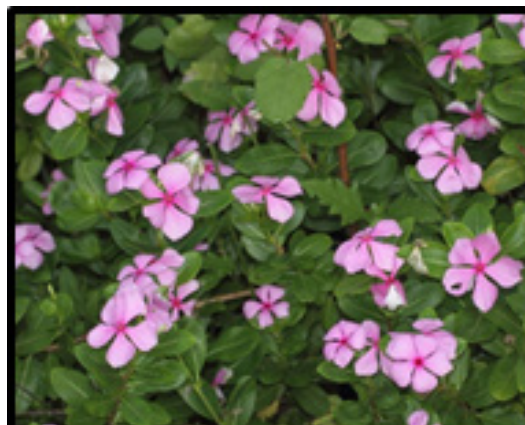


Fig. 12. *Catharanthus Roseus* (*Apocynaceae*)

chemopreventive potential; it is also non-toxic and reasonably priced³⁷.

Clinical significance

In most of Asia, betel leaf, also known as *piper betel*, is a highly prized cultural and medicinal plant. Clinical settings have examined its potential medicinal properties, such as its antibacterial,

anti-inflammatory, and antioxidant activities. As it may have properties that make it beneficial for upholding proper oral hygiene and acting as an adjuvant treatment for oral disorders, its potential to improve oral health has also been studied. More research is required to fully understand its clinical significance and potential applications³⁸.



Fig. 13. *Psidium guajava* (Myrtaceae)



Fig. 14. *Curcuma caesia* (Zingiberaceae)



Fig. 15. *Curcuma zedoaria* Rosc (Zingiberaceae)



Fig. 16. *Emblica officinalis* (Phyllanthaceae)



Fig. 17. *Bryophyllum pinnatum* (Crassulaceae)



Fig. 18. *Annona squamosa* L. (Annonaceae)

Ocimum Sanctum (Labiatae)

Ocimum sanctum has been shown to have anticancer activity in experimental studies conducted within the physiological paradigm by employing the extract of *Ocimum sanctum* on cultured fibrous sarcoma cells³⁹. experimental animals, the fresh leaf of It has been established that *Ocimum sanctum* has anti-carcinogenic as well as immune-boosting effect⁴⁰. *Ocimum sanctum* has been found to have anticancer properties in animal models. Additionally, it has been effectively investigated whether fibrous human cells within living cells as well as artificial insemination of a human cell line for cervical cancer (HeLa) and the cell line HEp-2 represents human laryngeal epithelial cancer⁴¹.

Clinical significance

Ocimum sanctum, also known as holy basil, is useful for therapeutic applications because of its antibacterial, cardioprotective, antioxidant, immunomodulatory, and neuroprotective properties. It helps the body adapt to stress and is believed to be an adaptogen. Because of these properties, it can be beneficial for improving overall wellbeing and treating a range of medical conditions⁴².

Catharanthus Roseus (Apocynaceae)

One such perennial herbaceous shrub that is a member of the Apocynaceae family is *Catharanthus roseus* (Linn). Although it goes by the regional Indian names sadabahar (in Hindi) and sadafuli (in Marathi), it is most commonly known as Madagascar periwinkle. It is well known for having significant medicinal and pharmaceutical qualities, including antiviral, antifungal, and antibacterial actions. It has been reported that the plant's leaves contain over 130



Fig. 19. *Murraya koenigii* Linn (Rutaceae)

different kinds of alkaloids⁴³. Alkaloids account for 0.74 to 0.82% of the total; vincristine, vinblastine, catharanthamine, and vincoline are among the major ones. Additional alkaloids include vincolinine, vinacardine, roseadine, vindolicine, rosicine, deoxyvinblastine, leurosine, pleurosin, leurocristine, and leurosidine⁴⁴.

Clinical significance

As vincristine and vinblastine are among the alkaloids found in *Catharanthus roseus*, popularly known as Madagascar periwinkle, they have significant clinical value. These alkaloids are used in chemotherapy to treat some solid tumors, leukemia, and lymphoma, among other cancers. Through stopping the growth of cancer cells, they work. However, more research is needed to support these claims. The plant has also been used in traditional medicine to treat conditions like diarrhea, hypertension, and diabetes⁴⁵.

Psidium guajava (Myrtaceae)

Expanding throughout the world's tropical and subtropical regions, *Psidium guajava* is a plant that contains a variety of bioactive substances, including flavonoids, guajadial, guavanoic acid, guayavolic acid, and guajaverin. Due to their numerous bioactivities, different plant parts have been utilized in conventional medication for a variety of illnesses, like ulcers, rheumatism, diarrheal illness, and antioxidant as well as antitumor activity⁴⁶. The guava plant, or *Psidium guajava*, is a small evergreen shrub that is a member of the Myrtaceae family. This plant is native to South America, Central America, and the Caribbean. The whole plant of the *Psidium guajava* tree has long been employed as topical applications or as an oral decoction, infusion, or



Fig. 20. *Hibiscus sabdariffa* (Malvaceae)

Table 1. Medicinal Plants and Their Anticancer Activities

Plants that fight cancer (family)	Portion of plant study	Solvent Used for Extraction	Bioactive Substance	Types of the Cancer	References
<i>Aloe capensis</i> (<i>Asphodelaceae</i>)	Leaves	Ethanol	(1,8-dihydroxy-3-(hydroxymethyl) anthraquinone	Lung and Liver	11
<i>Allium sativum</i> (<i>Amaryllidaceae</i>)	Bulb	Ethanol	Allicin, diallyl disulfide, diallyl trisulfide, S-2-propenyl-L-cystein	Blood, breast, prostate, skin, colon, and lung	14
<i>Margosa</i> (<i>Meliaceae</i>)	Leaf, Seed	Ethanol	Triterpenoids, limonoids, phenolics, and flavonoids	Liver, colon, lung, stomach, cervical, skin, prostate, and breast	11,17-19,70
<i>Carica posoposa</i> (<i>Caricaceae</i>)	Leaves	Water	kaempferol, quercetin, ascorbic acid myricetin-3-O-rhamnoside, papain, lycopene, morin, Benzylisothiocyanate, luteolin, cystatin, fisetin, and lycopene- β -D-glucopyranoside. Concomin	Liver, pancreas, blood, lung, and prostate	21,22
<i>Curcuma domestica</i> (<i>Zingiberaceae</i>)	Rhizomes	Ethanol	Ellagitannins, tannins, punicalagin, and ellagic acid	Liver, lung, stomach, colon, and breast	24
<i>Malum granatum</i> (<i>Lythraceae</i>)	Fruits	Water	O-methylated aglycones of flavones	Colon and Colorectal	26,27
<i>Citrus hystrix</i> (<i>Rutaceae</i>)	No Specified	Water	3,4,5-trihydroxybenzoic acid tannic acid, Lipeol and Mangiferin, galloyl glycosides	Colon, Pancreas, and Breast	29
<i>Mempelam</i> (<i>Anacardiaceae</i>)	Stalk and furrow	Methanol	10-shogaol, Zingerone, Shogaol, Eneaxosagol	Breast, Colon, kidney and Ovary	31,71
<i>Zingiber officinale</i> (<i>Zingiberaceae</i>)	Entire plant	Ethyl ester of acetic acid	Hydroxychavicol, piperol, chavibetol, piperbeto and eugenol	Breast, auxiliary gland in the reproductive system of men, Sphincter	33,34
<i>Roscoe</i> (<i>Zingiberaceae</i>)	Leaf	Acetone	Urosolic acid, Apigenin, glucuronide, Triacantanol ferulate, Vicenin-2, Molluscidin, Isorientin, Orientin, and Stigmasterol	Prostate, Buccal and Oral	36,37
<i>Ocimum Sanctum</i> (<i>Labiatae</i>)	Leaf	Aqueous	Tannins, Alkaloid, Reducing sugars, Protein, Steroids and triterpenoids and Saponin	Cervical and Gastric	39-41
<i>Catharanthus Roseus</i> (<i>Apocynaceae</i>)	FlowerLeaves	Aqueous	3,4,5-trihydroxybenzoic acid, Alkaptin, 5,7-tetrahydroxyflavon, delphinidi 3-glucoside, catechin, and galangin	Lung and Breast	43,44
<i>Psidium guajava</i> (<i>Myrtaceae</i>)	Fruit	Ethanol		Breast, Prostate, leukaemia, Liver	46,47

<i>Curcuma caesia</i> (Zingiberaceae)	Rhizomes	Hexane	Tannin, Saponin, Flavonoid & Glycosides.	Not Specified	49,50
<i>Curcuma zedoaria</i> Rosc (Zingiberaceae)	Rhizomes	n-hexane	diferuloylmethane, Terpenoid, Menthadiene , Eucalyptol, beta-elemene, zingiberene, dihydrocurcumin, P-Ethyl Methoxyethyl Cinnamic Acid , curione, beta-eudesmol, and germacrone Vitamin C, tannins and flavonoids	Ovarian	52,53
<i>Embllica officinalis</i> (Phyllanthaceae)	Fruit	Aqueous	Alkaloids, tannins, phenolic compounds, bufadienolides, saponin glycosides and flavonoids proanthocyanidins are a group of eighteen distinct phenolic compounds, primarily flavonoids and alkaloids.	Breast, uterus, pancreas, stomach and Liver Cervical	55,56
<i>Bryophyllum pinnatum</i> (Crassulaceae)	Leaves	Aqueous Alcohol			58,59
<i>Annona squamosa</i> L. (Annonaceae)	Fruit/Leaves	Methanol Chloroform		Cervical And Breast	61,62
<i>Murraya koenigii</i> Linn (Rutaceae)	Leaves/Stem/Bark	Ether/Chloroform Acetone	Alkaloids, coumarin glycoside, essential oil	Not Specified	64,65
<i>Hibiscus sabdariffa</i> (Malvaceae)	Flower/Leaves	Aqueous/Ethanol	Beta carotene, vitamin C, protein, citric, malic, tartaric and allo-hydroxycitric acid	Gastric Leukemia	67,68

boiled preparation to treat a variety of illnesses throughout Alkebulan, Asian, and South American countries⁴⁷.

Clinical significance

Clinically noteworthy are the antibacterial, antidiarrheal, antioxidant, wound-healing, antihyperglycemic, cardioprotective, and anti-inflammatory properties of guava, or *Psidium guajava*. It can be used medicinally to treat heart disease, infections, diarrhea, oxidative stress, diabetes, wounds, and inflammatory illnesses⁴⁸.

Curcuma caesia (Zingiberaceae)

Zingiberaceae includes the wild species known as turmeric. The plant's rhizomes are used in cosmetics as well as for sprains and bruises. Additionally, it is used as a carminative to treat rheumatic pain and headaches. Aromatic rhizomes produce an essential oil. Because essential oil is present, the rhizome's inside is bluish-black in color and has a distinctively sweet scent. (49) Due to its wide range of applications in treating impotence, fertility issues, leprosy, bronchitis, asthma, cancer, epilepsy, fever, and many other illnesses, it has enormous economic significance. Although this black turmeric is thought to be an endangered species due to widespread biopiracy, it also has many benefits and can treat a wide range of illnesses⁵⁰.

Clinical significance

Curcuma caesia, one member of the ginger family, may have antibacterial, antioxidant, and anti-inflammatory properties, which increase its therapeutic value. Traditional medicine offers advantages for conditions like arthritis, skin conditions, and respiratory issues. Although a number of studies point to potential anticancer benefits, more investigation is necessary before any firm conclusions can be drawn. Consult a physician before using it as medication⁵¹.

Curcuma zedoaria Rosc (Zingiberaceae)

One of *Curcuma*'s rare species is *Curcuma zedoaria*, or *C. zedoaria*. The *C. zedoaria* rhizomes, which were sourced from central Myanmar⁵². It has been discovered that white turmeric contains various kinds of primary and secondary metabolites. Arabic gums, essential oils, starch, and curcumin are the plant's principal constituents. Over ten types of sesquiterpenes have been identified in the rhizome of the plant, including furanodiene, which includes germacrone, 1,8-cineole, α -elemene,

and α -phellandrene, curcumin, α -eudesmol, zingiberene, and α -turmerone, and disobetarol⁵³.

Clinical significance

Curcuma zedoaria, sometimes known as white turmeric, has a number of therapeutic applications because of its bioactive ingredients. It possesses anti-inflammatory, antimicrobial, antioxidant, and anti-cancer qualities. Research has been done on the extracts' potential to treat a variety of illnesses, such as arthritis, gastrointestinal issues, skin conditions, and some types of cancer. More research is required to fully understand its clinical applications and side effects⁵⁴.

Emblica officinalis (Phyllanthaceae)

Amla, or *Emblica officinalis*, has historically served as a medication for a quantity of illnesses and is thought to strengthen the immune system. Cancer, diabetes, liver problems, heart disease, ulcers, snake venom, hemorrhage, diarrhea, dysentery, anemia, and ocular disorders are among the conditions for which it is specifically used. antimicrobial, antipyretic, cytoprotective, immunomodulatory, antioxidant, anticancer, and among amla's significant qualities are its antitussive and gastroprotective qualities. Amla contains vitamin C, tannins, and flavanols⁵⁵. Indian traditional medicine has used amla, or extracts from the Indian gooseberry (*Phyllanthus emblica officinalis*), for centuries to cure a range of illnesses, from cancer to constipation⁵⁶.

Clinical significance

In traditional medicine, *Emblica officinalis*, also known as amla or Indian gooseberry, is highly valued due to its potent antioxidant properties. Because of its high vitamin C content and other phytochemical content, it is beneficial for many medical conditions. Research suggests that it may protect against oxidative stress-related illnesses, boost immunity, improve skin health, promote hair development, and help manage diabetes. To fully understand its clinical significance and to suggest a dose for specific illnesses, however, more clinical trials are needed⁵⁷.

Bryophyllum pinnatum (Crassulaceae)

Bryophyllum pinnatum was widely used in traditional medicine. They are especially common in Africa, India, and Asia's tropical regions. The plant, also called Parnabeeja, is used as a kidney treatment by the people of Bengal and southern India. It is widely used to treat

homeostasis and wound healing. Moreover, it functions as an analgesic, anti-arthritic, anticancer, antiallergic, nephroprotective, liver-protective, and antiulcer agent for medical conditions such as CNS depression. This survey of plants highlights the chemical components, medicinal uses, and biological activity of plants⁵⁸. Alkaloids, flavonoids, glycosides, steroids, bufadienolide, and organic acid are the plant's principal components, according to reports. This review focuses on *Bryophyllum pinnatum*'s folk occurrence, wide range of phytochemicals, and pharmacological activities⁵⁹.

Clinical significance

The "life plant" or "miracle leaf," *Bryophyllum pinnatum*, has long been employed in a variety of traditional medical procedures. Its application in the treatment of gastrointestinal disorders like dysentery and diarrhea, respiratory ailments like asthma and bronchitis, and its possible anti-inflammatory and antibacterial qualities are a few possible clinical implications. Nevertheless, additional thorough scientific research is required to completely comprehend its safety profile and clinical efficacy⁶⁰.

Annona squamosa L.(Annonaceae)

The sugar apple is a member of the family Annonaceae. Sweetsop is another name, and it is a popular tropical fruit that is grown in Egypt, the Bahamas, Bermuda, Ecuador, Peru, Brazil, India, Mexico, South and Central America, the West Indies, and Brazil. The custard apple plant's leaf has been investigated due to its potential health advantages, which are linked to a wide variety of plant chemicals. Proanthocyanidins, which are composed of eighteen distinct phenolic compounds, primarily flavonoids and alkaloids, are examples of phenol-based compounds. The biological activities of *Annona squamosa* leaf extracts, or ASLs, have been investigated. These activities include lipid-lowering, hepatoprotective, antioxidant, anticancer, and anti-diabetic properties⁶¹. In Gujarati, this plant is called Sitaful, and in English, custard apple. Alkaloids, including glaucine, anonaine, aporphine, roemerine, norcorydine, corydine, and norisocorydine, are found in diverse plants. A portion of custard apples⁶².

Clinical significance

Because *Annona squamosa* may have antibacterial, antioxidant, anti-inflammatory, and

anticancer properties, it is clinically significant. Fruit, leaves, seeds, and bark are just a few of the plant parts that have long been used in folk medicine to treat ailments like diarrhea, fever, dysentery, and nail infections. *Annona squamosa* extracts have also been shown in lab studies to have the ability to reduce oxidative stress and inhibit the growth of cancer cells. To fully appreciate and utilize its therapeutic potential, however, additional research is necessary⁶³.

***Murraya koenigii* Linn (Rutaceae)**

Recognized by most as a Meethi Neem, *Murraya koenigii* Linn (*Rutaceae*) is an aromatic, mostly deciduous shrub. It serves as an antiemetic, blood purifier, tonic, stomachic, febrifuge, antidiarrheal, and dysentery, as well as enhancing flavor in curries and chutneys in the conventional medical system⁶⁴. Using standard protocol, a qualitative chemical test of several *Murraya koenigii* extracts was conducted. The extracts contain alkaloids, flavonoids, coumarins, steroids, and carbohydrates⁶⁵.

Clinical Significance

Murraya koenigii Linn, also known as curry leaf, is a clinically significant herb because of its antibacterial, anti-inflammatory, hypoglycemic, hepatoprotective, and gastroprotective properties.⁶⁶

***Hibiscus sabdariffa* (Malvaceae)**

The plant *Hibiscus sabdariffa*, also known as “red sorrel” or “roselle,” belongs to the family *Malvaceae*. With over 300 species spread across tropical and subtropical regions of the globe, this plant is widely known for its medicinal properties. When the weather gets warmer and more humid, roselle can adapt to a vast array of soil types. Natural acids, for example, citric, tartaric, and malic, as well as allo-hydroxycitric acids, are abundant in roselle⁶⁷. It was discovered that *H. sabdariffa*’s crude extracts and isolated compounds may act as cancer-preventive chemopreventive agents. *Hibiscus* anthocyanins (Has), for example, have been shown to encourage apoptosis in cancer cells, especially in leukemia and gastric cancer⁶⁸.

Clinical significance

The plant *Hibiscus sabdariffa*, popularly known as Roselle, may offer a variety of therapeutic benefits, including antioxidant properties, anti-inflammatory effects, cardiovascular support, liver protection, aid in weight management, potential for

diabetes management, support for renal health, and gut health promotion⁶⁹.

Bioactive substances having antitumor properties: classifications

The primary categories of bioavailable substances derived from therapeutic plants that exhibit antitumor properties comprise alkaloids, tannins, triterpenes, flavonoids, polyphenols, and quinones. Such bioavailable substances caused cell cycle termination, reduced angiogenesis, decreased cancer cell survival, and demonstrated properties that are anti-oxidative, anti-proliferative, cytotoxic, cytostatic, and antimetastatic.

Polyphenols

Secondary metabolites, known as polyphenols, are a broad class of chemicals that are widely expressed in plants and have diverse functions in signal transduction, pathogen defense, and UV light absorption. Plant-based foods and drinks Fruits, vegetables, grains, legumes, nuts, olives, chocolate, tea, coffee, and wine are among the foods that contain polyphenols. The health benefits of polyphenols for humans are numerous and include attributes that include immunomodulatory, antiviral, antimicrobial, anti-inflammatory, and anticancer effects. An average cell gradually changes into a cellular cancer through a series of steps known as carcinogenesis. The causes of malignant transformation are either tumor suppressor genes—genes that regulate cell growth—loss of expression or functional inactivation, or oncogenes—genes that promote cell survival and proliferation—overexpression or hyperactivation⁷².

Flavonoids

Among the many different types of phenolic compounds found in higher plants are flavonoids. Strong bioactive substances known as flavonoids have anticarcinogenic properties because they can alter cellular proliferation, apoptosis, and metastasis to impede the start, spread, and progression of cancer⁷³. It was reported that the flavonoids had high free radical-scavenging activity and were toxic to cancer cells. Alpinumisoflavone and 4'-methoxylicoflavone, two flavonoids, caused human leukemia to undergo apoptosis by means of extrinsic and intrinsic signaling pathways. This process resulted in the destruction of the cell's mitochondria, which ultimately caused the cell to die³⁴.

Alkaloids

Both the growth of tumor cells and the process tumorigenesis were disrupted by those biologically active substances. By triggering death within cells and stimulating the cell cycle of cancer through the through the termination of the G1/M as well as G2 phases, the alkaloids slowed the growth of cancerous cells. (34) Haemanthidine is another alkaloid of the â-crinane type that is obtained from 5,10-â-ethanophenanthridine, and it has drawn interest as a potential anticancer agent⁷⁴.

Saponins

Many pharmacological actions of saponins have been identified, including their capacity to modulate immunity through the interaction of cytokines and their cytotoxic and cytostatic impacts on cancerous tumor cells. A desert tree found in Australia is called *Acacia victoriae* (Fabaceae). Regarding this, it has been demonstrated to cause apoptosis within the breast cancer cell line MDA-MB-453 in humans and cycle of cell (G1) arrest in the MDA-MB-435 (breast cancer) and Jurkat (T cell leukemia) cell lines⁷⁵.

Tannins

Certain tannins, like ellagiatannin, have been shown to have anticancer pharmacological effects. These actions have been linked to increased control over the E cycle as well as a reduction in cyclin A and B1 expression, blockage of the S-phase of the cell cycle, and the initiation of apoptosis by inhibiting BCL-XL via the intrinsic pathway and cytochrome C secreted by cytosolic mitochondria, as well as the induction of caspase-9 and caspase-3³⁴. Many different kinds of plants contain tannin. These are heavy-molecule phenolic compounds. Plant tissue's outer layers, bark, roots, and stems all contain tannins. They dissolve in both alcohol and water⁷⁵.

Quinones

Quinones, like aloe-emodin, prevented cancer cells from proliferating by obstructing the G1/G2/M-, or S-phases of the cell cycle. Quinones caused ROS, which in turn promoted DNA damage. Quinones-induced caspases, the Fas pathway, the p53 pathway, and apoptosis in cancerous cells³⁴.

CONCLUSION

The review has screened 20 important medicinal plants for various tumors like phallus,

hernia, lungs, epidermis, colon, oropharynx, sanguine, ovaries, breasts, abdomen, throat, and renal. These findings suggest that these medicinal plants may find application as agents for anticancer drugs. The main groups of bioactive substances that have been linked to anti-tumor action are alkaloids, tannins, triterpenes, flavonoids, polyphenols, and quinones. These bioactive compounds exhibited major anticancer pharmacological actions, including cytotoxic, antiproliferative, antimetastatic, apoptotic, and antioxidative effects; they also triggered arrest of the cell cycle, inhibited angiogenesis, and decreased viability in cancer cells. The current review demonstrated that the majority of bioactive compounds found in Indian medicinal plants were primarily derived from their leaves, roots, and stem bark extracts, which demonstrated antitumor properties. Consequently, it is advised to conduct additional research on the anti-tumor properties of the leaf extracts, roots, and stems of these Indian medicinal plants. Given that the botanical species included in this critique exhibited encouraging antitumor properties, Indian plants used medicinally may be used in the future to produce widely accessible and reasonably priced anticancer medications.

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Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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Conceptualization- Vivek Burunkar and Dr. Lalita s Nemade; Abstract – Vivek Burunkar and Mamata kadam; Introduction -Vivek Burunkar and Ruchita bhagwat; Clinical significance -Vivek Burunkar and Ruchita Bhagwat; Herbs information – Vivek Burunkar and Shruti tikam; Conclusion – Vivek Burunkar and Viraj kamat; Supervision -Dr. Lalita s. Nemade

Data Availability Statement

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