



A Systematic Review of Medicinal Plants Used in The Treatment of Various Types of Cancer

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Abstract: Cancer is a category of diseases characterized by abnormal cell proliferation. Possible symptoms and signs include a lump, unusual bleeding, a persistent cough, unexplained weight loss, and a change in bowel habits. These signs could be cancer-related but could also be due to other conditions. People are choosing to use natural plant items for cancer treatment more frequently in recent years due to concerns about side effects. Due to their effectiveness and lower toxicity compared to contemporary drugs, traditional medicines are supported by the World Health Organisation (WHO). The main goal of this review is to draw attention to the potential of recently discovered anticancer chemicals from traditional medicinal plants to be exploited as leads for the development of anticancer drugs. The current paper is an in-depth analysis of numerous literature sources. For researchers and scientists worldwide, this review is useful to investigate the medicinal value of herbal plants against cancer and develop new drugs from them.

Keywords: Cancer, Symptoms, Diseases, Traditional medicines, and Drug discovery.

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I. INTRODUCTION

Throughout history, humans have relied on nature for their basic needs, such as food, housing, medicine, clothes, flavourings, fertilizers, and transportation. This is especially true in developing nations, where herbal medicine has a long use history and medicinal plants play a significant role in the healthcare system for vast segments of the world's population. Developed and developing countries are increasing their development and acknowledging these plants' medical and commercial benefits.¹ Plants are a significant medication source and essential to maintaining global health. It has long been known that medicinal herbs or plants can be a valuable source of therapies or curative help. All around the world, the usage of medicinal herbs has come to dominate the healthcare system. This entails the use of medicinal plants as potential tools for preserving health and conditions as well as for the treatment of diseases. Two-thirds of the world's population, or many countries, rely on herbal medicine as their primary form of healthcare. This is because they are more socially acceptable, better suited to the human body, adaptable, and have fewer negative side effects.² Herbal medicine is as old as human civilization and has developed with it. Around the world, local healers have used native plants and herbs for ages to cure various diseases and demonstrated obvious pharmacological activity. Historically, herbal medicines were used as tinctures, poultices, powders, and teas. Formulations and pure components were then used. Across all societies, local folklore that has been passed down from families, tribes, and cultures contains knowledge about the usage of medicinal herbs. Since the beginning of time, people have employed medicinal plants or their extracts to treat a variety of illnesses and create valuable pharmaceuticals.³ With significant advancements in treatments and prevention measures, cancer has remained an ongoing battle on a global scale. The condition is distinguished by uncontrollable or irreversible cell proliferation in the human body. Resulting in the growth of cancerous tumours that have the potential to spread through the body. Chemotherapy, radiation, and medications made from chemicals are currently used as therapies. Chemotherapy is one treatment that can put people under a lot of stress and worsen their health. As a result, emphasis is placed on adopting complementary and alternative medicines to treat cancer.^{4,5} Cancer is a disease that adversely affects people worldwide and finally causes death. The condition is distinguished by unregulated mitotic divisions of human body cells, which result in tumours of malignant cells and can cause a metastatic state. By compressing, crushing, and obliterating the non-cancerous cells and tissues around them, tumours are the primary cause of many cancer symptoms. The cell's DNA is harmed by chemical and environmental causes, leading to this unusual growth. The environment includes things like exposure to tobacco smoke.^{6,7} The main contributors to cancer are cigarette smoking, nutritional imbalances, hormones, and persistent infections that promote chronic inflammation. Cancer treatment is based on the type and stage of the disease. These include operations, radiation, chemotherapy, biological, hormone, and other therapies. Chemotherapy and radiation therapy can have unpleasant side effects, including exhaustion, disturbed sleep, loss of appetite, hair, sore mouth, changes in taste, fever and infection, anxiety, depression, nausea, and vomiting, despite being used to treat cancer. Managing these side effects is frequently challenging.^{8,9} These treatments negatively impact the immune system, cardiac conditions, renal and urine

bladder ailments, gastrointestinal disorders, neurologic and psychological alterations, hormonal and reproductive issues, heart diseases, and other organs.¹⁰ Cancer is caused by the dysregulation of one or more biological mechanisms, such as cell division and apoptosis, which are essential for the growth and proliferation of healthy cells. The main goal of medication development and candidate screening is to pinpoint the difference(s) in regulatory mechanisms operating in cancer cells that are accountable for transformation and then precisely target those processes.¹¹⁻¹³

2. VARIOUS PLANTS USED IN THE CANCER TREATMENT

3. BREAST CANCER

Breast cancer is the most often diagnosed cancer and the leading cause of cancer-related death in women worldwide. Finding efficient treatments with little adverse effects is urgently needed to lessen this load. A growing body of research indicates that plant chemicals may be very effective in treating a variety of malignancies. Indeed, several phytochemicals have shown promise in treating breast cancer in clinical trials.¹⁴

3.1. *Justiciaadhatoda*

Justicia adhatoda (Acanthaceae), also referred to as Malabar or Vasaka, is a significant medicinal plant utilized in various traditional medical systems, including Ayurveda. With a focus on the breast cancer cell line MCF-7, an early study assessed the anticancer activities of *Justiciaadhatoda* leaf extract.^{15,16}

3.2. *Kigelia Africana*

The medicinal plant *Kigelia africana* is distinguished by pendulous racemes of colourful flowers and fruit with a long stem that resembles a giant gourd. A reported study on this plant was done for anticancer effect. The suphorhodamine (SRB) assay assessed the extracts' *in-vitro* anti-cancer effects against a human breast cancer cell line. In this study, we show the *in vitro* efficacy of *Kigelia africana* dichloromethane and methanol extracts against the HCC-1937 breast cancer cell line and characterise the chemical profiles of the two extracts.^{17,18}

3.3. *Vanda spathulata*

Bandaa or Svarna-pushpabandaa are common names for the beautiful orchidaceous *Vanda spathulata* (L.) Spreng plant. *V. spathulata* leaf extracts on MCF-7 cell growth and apoptosis were studied whether they have anticancer capabilities. Methanol was used to extract the leaves. Anticancer activity was examined using MTT.¹⁹

3.4. *Grangeamadera spatana*

The Compositae (Asteraceae) family has just six species in the genus *Grangea*, most native to Africa, South Asia, and Southeast Asia. One of the most popular medicinal plants used in traditional Thai medicine is *Grangeamadera spatana*. The whole plant can be consumed to promote digestion, lessen pain and inflammation, and regulate menstruation, while the leaf can be used to lessen spasms. An early study determined whether certain human breast cancer cell lines (MCF-7, MDA-MB-468, and MDA-MB-231) might be used to test the anti-breast cancer potential of the chemical

frullanolide, which was isolated and purified from the plant *Grangeamaderaspatana*. Breast cancer cell lines' cytotoxic activity was evaluated using the MTT test.²⁰

3.5. *Galenia Africana*

A perennial plant called *Galeniaafricana* is also called Kraalbos

or Geelbos. It is native to Southern Africa and is primarily found in Namaqualand and the Karoo. An early work examined the anti-cancer activity of an ethanolic extract of Kraalbos leaves, KB2, against estrogen receptor-positive (MCF-7) and triple-negative (MDA-MB-231) breast cancer cells.²¹



Fig: 1 Medicinal plants for Breast cancer

4. COLON CANCER

Colon cancer is the third most fatal and one of the most often detected diseases worldwide. Colon cancer still claims hundreds of thousands of lives each year worldwide, despite improvements in survival due to routine screening and early identification during the past few decades. The current standard of care includes surgery and chemotherapy, but the toxicity of these treatments highlights the urgent need for improved therapies. Plants are excellent potential sources of innovative treatments, as evidenced by the fact that about 50% of chemotherapeutic medications are either direct or indirect offspring of chemicals derived from medicinal plants.²²

4.1. *Murraya koenigii*

In a study, silver nanoparticles (Ag NPs) were created using a silver nitrate solution and *Murraya koenigii* plant extract. On the HT-29 colon cancer cell line, the MTT assay was used to assess the nanoparticles' anticancer potential. According to

this study, silver nanoparticles made by *Murraya koenigii* may be a good treatment candidate for colon cancer.²³

4.2. *Phyllanthus emblica*

The deciduous gooseberry or Amla tree, *Phyllanthus emblica*, belongs to the Phyllanthaceae family. An early study aimed to look into the fruit *Phyllanthus emblica*'s antioxidant and anticancer properties. The antioxidant potential of the edible plant was assessed *in vitro* using the FRAP assay method and the DPPH (1, 1 diphenyl 2 picrylhydrazyls) scavenging assay. More potential cytotoxic activity is present in *Phyllanthusemblica* regarding HT-29 cell lines. According to the findings, this plant extract may be a valuable food source with antioxidant and anticancer properties.²⁴

4.3. *Eclipta alba*

Asteraceae is a family of annual herbaceous plants that includes the upright or prostrate *Eclipta alba*. It is also referred to as Bhingaraj in Ayurveda and has been used to cure various conditions, particularly those affecting the liver

and hair. Maceration was used to extract phytochemicals utilizing *Eclipta alba* complete, shade-dried plant as the source. The anticancer activity of the extract was examined and reported using several cancer cell lines, including Human Colorectal Carcinoma (HCT-116), Human Prostate Cancer (PC-3), Michigan cancer foundation-breast cancer (MCF-7), and renal cell carcinoma (RCC-45). By employing the MTT (Methyl Thiazoldiphenyl Tetrazolium Bromide) assay, clonogenic (colony formation), and migration assays on normal human embryonic lung fibroblast cells (WI-38), we have also examined the effects.^{25,26}

4.4. *Calotropis gigantea*

In Africa, Eastern Asia, and Southeast Asia, including Thailand, the plant *Calotropis gigantea* (Apocynaceae, Asclepedaceae) is commonly cultivated. Therefore, this work assessed how

Calotropis gigantea stem bark extracts affected colon cancer cells' growth inhibition and apoptosis induction. To develop a novel anticancer regimen for potential use in cancer therapy research, a study examined the effects of combining *Calotropis gigantea* stem bark extracts with 5-FU. The Dichloromethane (DCM) fraction of the *Calotropis gigantea* stem bark extract become clear in light of these findings as a valuable source for the purification of novel strong anticancer drugs in the future.²⁷

4.5. *Asparagus aethiopicus*

The family Asparagaceae includes the asparagus plant known as *Asparagus aethiopicus* (Sprenger plant/Asparagus greens). The early study reported an antioxidant, *in vitro* anticancer activity, and *in vitro* primer phytochemical assessment against HT-29 colon cancer cell lines.²⁸



Fig 2: Medicinal plants for Colon cancer

5. LIVER CANCER

Hepatitis, also called liver disease, is an inflammation of the liver. Viruses, bacteria aflatoxin, continued alcohol use, and medicines that enter the body in various ways can all harm liver function. These organs are frequently exposed to toxins since the liver performs several metabolic tasks. These compounds will be detoxified and rendered inactive so they

won't damage the body. In the fight against cancer, chemotherapy, radiation, hormone therapy, immunological therapy, and surgery have had mixed results. However, this type of treatment results in significant negative effects. Numerous scholars have been drawn to the continuous study of natural medicine, such as everyday foods or nutraceuticals. Plants play a crucial role in the development of anti-cancer medications. According to conventional

wisdom and exploratory studies, numerous medicinal herbs have been claimed to have an anti-cancer effect.²⁹⁻³¹

5.1. *Cassia auriculata*

An early study reported the antioxidant and anticancer properties of the flower extracts of *Cassia auriculata* in acetone and methanol. The effectiveness of antioxidants was tested against hydroxyl and DPPH free radicals. The inhibitor was used on liver cancer cell lines to test the anticancer activity. Methanol extract had higher antioxidant activity against the DPPH free radical (IC₅₀: 46.28 g/ml) than acetone extract (IC₅₀: 52.60 g/ml). Methanol and acetone extracts were found to have IC₅₀ values for the hydroxyl radical of 47.05 and 56.01 ± 1.85 g/ml, respectively. The methanol extract was shown to have the highest anticancer activity, 36.102.46 g/ml. Methanol extract, one of these, has a significant antioxidant and anticancer action.³²

5.2. *Avicennia marina*

The grey mangrove tree is *Avicennia marina* (Avicenniaceae). It grows by the seaside and is resistant to excessive salinity. *Avicennia marina*'s anticancer effects on the HepG2 cell line were investigated. Soxhlet equipment was used to create the current experiment's crude methanol extracts of *Avicennia marina*. Using the MTT assay (3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide), mangrove plant extracts were applied against the chosen cell line at eight different concentrations (7.8, 15.6, 31.2, 62.5, 125, 250, 500 and 1000 g/ml).³³

5.3. *Calotropis gigantea*

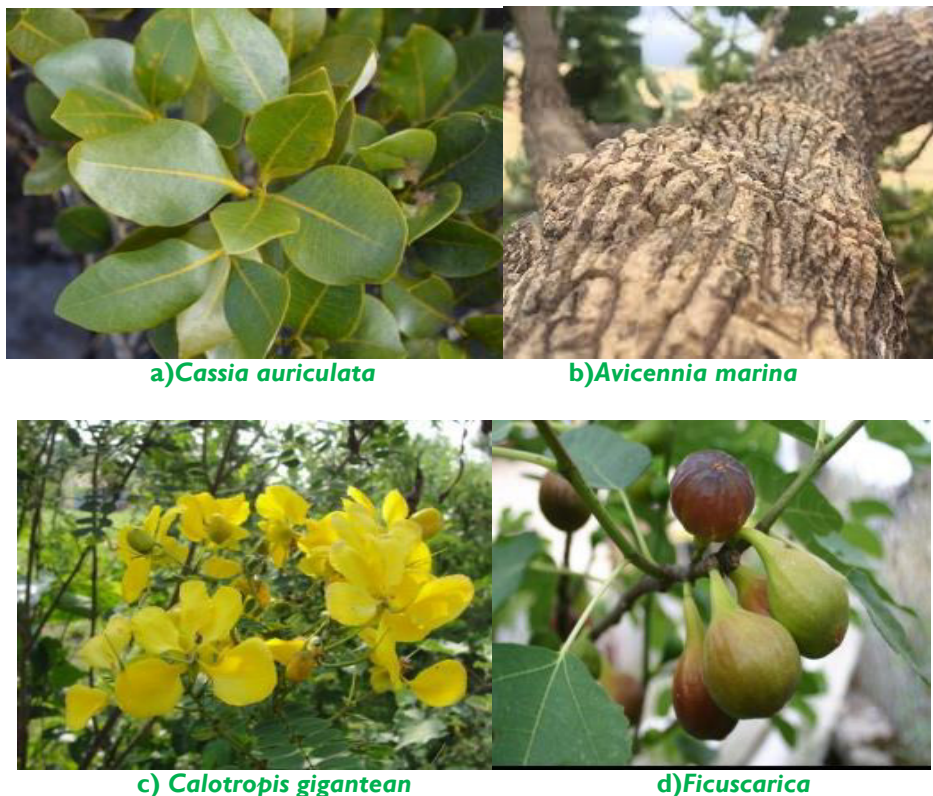
Globally, *Calotropis gigantea* (Apocynaceae, Asclepedaceae) is frequently used as a folk remedy for various diseases. In order to investigate the anticancer potential of crude extracts from the stem bark of *Calotropis gigantea*, which were separated into Dichloromethane, Ethyl acetate, and Water fractions. In a study it was examined for the Adenosine Triphosphate (ATP) synthesis inhibition, which mediates apoptotic activity, in HepG2 cells.³⁴

5.4. *Ficus carica*

With about 750 species of woody plants, trees, and shrubs spread across subtropical and tropical regions of the world, *Ficus carica* is one of the largest genera of medicinal plants. This study determined whether the methanol extract of *Ficus carica* leaves and fruits had any anticancer properties against Huh7 cells proliferation, apoptosis, and necrosis. According to the flow cytometry study, leaf extracts showed more Huh7 cell apoptosis and necrosis than fruit extracts.³⁵

5.5. *Hibiscus sabdariffa* L

To the Malvaceae family belongs this *Hibiscus sabdariffa* Linn. To test the cytotoxicity potential of the solid made from the ethyl acetate fraction of *Hibiscus Sabdariffa*, *in vitro* anticancer activity was conducted in an early reported study. Various doses of L flower extract were tested on the HepG2 cell line. It is predictable to confirm cytotoxicity using the MTT (MethylThiazolyl diphenyl- Tetrazolium bromide) assay for cell viability and indicators.³⁶





e) *Hibiscus sabdariffa* L

Fig 3: Medicinal plants for Liver cancer

6. LUNG CANCER

Lung cancer is one of the leading causes of death in both males and females worldwide. There are two types of lung cancer based on biological characteristics and clinical performance: small and non-small cell. lung cancer. Small-cell lung cancer accounts for 15–20% of all lung cancers; within this category, 20% occurs in smokers. Non-small-cell lung cancer accounts for 80–85% of all lung cancers and can be further categorized into adenocarcinoma, squamous cell carcinoma, and large cell carcinoma.^{37,38}

6.1. *Alnusnitida*

Alnusnitida belongs to the family Betulaceae. Two lung cancer cell lines, A549 and H460 (Human non-small lung cancer cell lines), were tested for growth suppression using Methanol extracts of the leaves and stem bark of *Alnusnitida*. Both cancer cell lines were significantly slowed down in their growth after treatment. A549 and H460 cancer cell lines' exposure to ANL and ANB decreased cell migration, colony development, and survival. After staining with rhodamine-phalloidin, A549 and H460 treated with ANL and ANB revealed altered actin fibers. These findings imply that ANL and ANB should be researched more thoroughly for therapeutic purposes in lung cancer.³⁹

6.2. *Clerodendrumfragrans*

Clerodendrumfragrans, a member of the Lamiaceae family, is a sesewanua plant. The MTT tetrazolium test was used to assess the anticancer activity of *Clerodendrum fragrans* extracts and fractions against A549 lung cancer cells.⁴⁰

6.3. *Cardiospermumhalicacabum*

The family Sapindaceae includes *Cardiospermum halicacabum*. Balloon vines is the other name, and it flourishes in tropical and subtropical areas. *Cardiospermum halicacabum* anticancer activity against A549 was assessed using an inverted phase contrast microscope and the MTT test to detect the anticancer activity. This early study assessed *Cardiospermum halicacabum* *in vitro* anticancer efficacy against the human A549 lung cancer cell line.⁴¹

6.4. *Alangium longiflorum*

In Borneo and the Philippines, *Alangium longiflorum* (family: Alangiaceae) is also called Malatapai. *Alangium longiflorum* has cytotoxic activity against human lung (A549) and breast (MCF-7) cancer cells which was first determined by the MTT assay, then contrasted with doxorubicin. Demethyl cephaeline, an alkaloid found in the plant's stem bark, was highly cytotoxic to the A549 lung cancer cell line and the MCF-7 breast cancer cell line.⁴²

6.5. *Cuscutare flexa*

The *Cuscutare flexa* (Family - Cuscutaceae) plant is regarded as the most important in the Unani medical system and is used in traditional medicines to treat cancer and other ailments. To assess the anticancer activity of *Cuscutare flexa* extracts using the H-1299 cell line. For stem and seed extraction, a Soxhlet method was used. Additionally, the anticancer efficacy of each extract's fractions obtained by Flash chromatography was examined. Additionally, each fraction's antioxidant activity was tested. A DNA binding analysis confirmed the outcomes of the entire process. Using ELISA, cellular death was found.⁴³



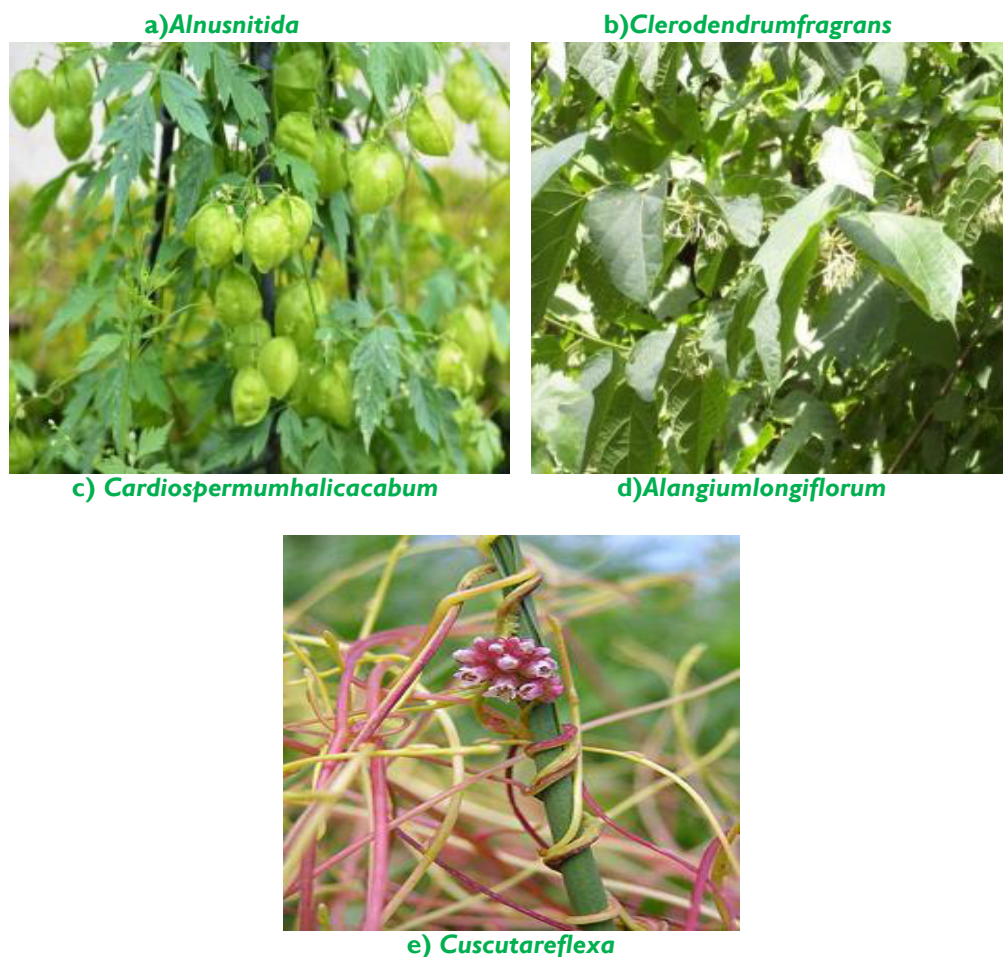


Fig: 4 Medicinal plants for Lung cancer

7. PROSTATE CANCER

In the Western world, prostate cancer is the second most prevalent malignancy and the third most frequent cause of cancer mortality. Its aetiology is thought to be related to genetic, hormonal, nutritional, age-related, racial, and environmental variables. Its pathophysiology is relatively and poorly understood. Age-related changes in testosterone levels have been hypothesised to have a significant role in developing benign prostatic hyperplasia and prostate cancer.⁴⁴⁻⁴⁷

7.1. *Combretum fragrans*

Combretum fragrans is a member of the Combretaceae family. It is frequently used to treat various illnesses and conditions, including pain and inflammation, cough, hypertension, wounds, syphilis, leprosy, fungal scalp infections, malaria, gonorrhea, and snake bites. In a study, prostate cancer (PC-3) cell lines were used to test the anticancer activity and mode of action of a Methanolic extract of the stem bark of *Combretum fragrans*.⁴⁸

7.2. *Cratevanurvala*

An early work on *Cratevanurvala* used testosterone and the cancer-causing compound N-Methyl-N-Nitrosourea (MNU) to establish prostate cancer in male Wistar rats. The anticancer potential of an ethanolic extract of *Cratevanurvala* bark was assessed.⁴⁹

7.3. *Eichhornia crassipes*

The scientific name for *Eichhornia crassipes* (Pontederiaceae) is Water Hyacinth. *In vitro* tests using the Michigan Cancer Foundation-7 (MCF-7), Henrietta Lacks (HeLa), European Collection of Authenticated Cell Cultures (ECACC), and HepG2 cell lines revealed that crude whole-plant methanol extracts were highly efficient. While preserving the T47D cell line from damage, the aqueous leaf extract of *Eichhorniacrassipes* inhibited the NCI-H322 cell line. According to one study, *E. crassipes* extract is not effective against the human prostate cancer cell lines PC3.⁵⁰

7.4. *Leea indica*

The large evergreen shrub *Leea indica* is a native of tropical India, Bangladesh, China, Bhutan, and Malaysia. By using the 3-(4,5-dimethylthiazole-2yl)-2, 5-diphenyl tetrazolium bromide) MTT assay assessed the *in vitro* anticancer activity on the human prostate cancer cell lines DU-145 and PC-3. The outcomes show that for the human prostate cancer cell lines DU-145 and PC-3, *Leeaindicawas* a potential antioxidant and anticancer agent.⁵¹

7.5. *Prunusafricana*

Prunus africana (Rosaceae family) is a medicinal plant with potent antiprostata cancer properties. The effects of 70% ethanolic root extracts of six-month-old micropropagated *Prunusafricana* (PIR), a therapy option to the more conventional *Prunus Africana* stem bark extract (PWS), on PC-3 prostate cancer cells *vitro*. DAPI labelling, annexin-V and propidium iodide staining, and western blotting

measurement of caspase-3 activity were all used *in vitro*

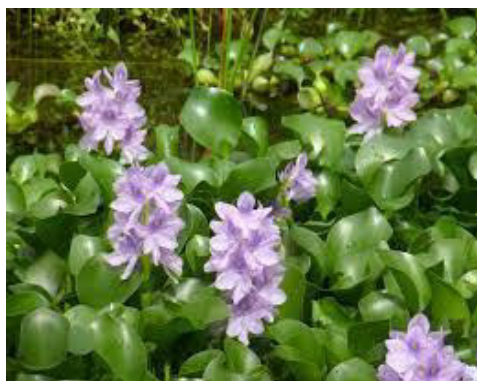
tests on PC-3 cells.⁵²



a) *Combretum fragrans*



b) *Crateva nurvala*



c) *Eichhornia crassipes*



d) *Leea indica*



e) *Prunus africana*

Fig: 5 Medicinal plants for Prostate cancer

8. CONCLUSION

This systematic review comprehensively examined the use of medicinal plants for treating different types of cancer. The study highlighted the potential of these plants as alternative or complementary therapies in cancer treatment. Various medicinal plants exhibited promising anticancer properties, including antioxidant, anti-inflammatory, and anticancer activity. However, further research is needed to determine these plant-based treatments' safety, efficacy, and optimal dosage. Integrating traditional medicine with modern approaches could lead to the developing of new and effective cancer therapies. Overall, medicinal plants hold great potential for advancing cancer treatment, but extensive studies are essential before their widespread use can be recommended.

9. AUTHORS CONTRIBUTION STATEMENT

Nithya.M conceptualized the study. Nithya.M, Revathi.M, and Dhivya.M designed the treatment protocol. Nithya.M did screening for the eligibility of the searched studies individually based on inclusion and exclusion criteria. Nithya.M and Revathi.M statistically analysed the data collected; Nithya.M, Revathi.M, Dhivya.M discussed the study. All the authors contributed to designing the manuscript. All the authors read and approved the final version of the manuscript.

10. CONFLICT OF INTEREST

Conflict of interest declared none.

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