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Ornamental plants as anti-cancer compositions

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ABSTRACT

Ornamental plants are plants which are mainly grown for their aesthetic value such as beautiful flower, leaves etc., however there are many ornamental plants that have medicinal uses as well. In this article, we would like to review the enormous potential of ornamental plants in relation to medical treatments such as cancer, which has become very common in recent years. Many anticancer lead bioactive molecules such as vinca alkaloid, vinblastine, vincristine, camptothecin, and taxanes have been characterized from different medicinal plants and are used as therapeutic agents worldwide. Aloe vera and their antioxidant secondary metabolites in treating ovarian cancer, *Catharanthus roseus* in human epithelial cervical carcinoma cell line, *Rosa canina* L. as anti-tumor and genoprotective, *Alcea rosea* as anticancer, *Catharanthus roseus as* anti-inflammatory and anticancer, *Taxus bacata* against human colon cancer, *Podophyllum peltatum* for treating testicular cancer, lung cancer, lymphoma, leukemia, neuroblastoma, and ovarian cancer, *Alcea rosae* in treatment of colorectal cancer, suppression the proliferation of PLC/PRF/5 cells by inducing apoptosis by *Amorphophallus campanulatus* extract, etc. *Bergenia ciliatahave* potential to work against neoplastic activities due to which it acts as defensive medicine. Therefore, communication between agricultural science specialists and the use of the capacities of this field, especially ornamental plants, and medical sciences, can reveal other aspects of ornamental plant cultivation.

Keywords: bioactive molecules, plant-derived anticancer compounds, Antioxidant activity, ornamental plants, phytochemicals.

Introduction

Natural therapies, such as the use of plant-derived products in the treatment of cancer, may reduce adverse and toxic side effects. However, many plants exist that have shown very promising anticancer activities in vitro and in vivo but their active anticancer principle have yet to be evaluated. Combined efforts of botanist, pharmacologist and chemists are required to find new lead anticancer constituent to fight disease. This review will help researchers in the finding of new bioactive molecules as it will focus on various plants evaluated for anticancer properties in vitro and in vivo. Plants' anticancerous powers is known for millennia. The separation of podophyllotoxin and chemicals like lignans from common mayapple (*Podophyllum peltatum*) created medications for treatment of small cell lung and testicular cancer. Roughly 36,000 species of plant are investigated for anticancerous properties by the National Cancer Institute. Approximately 3500 plant species have shown repeatable anticancer action (Pooja, 2017).

Application of pure medicinal compounds have superiority over the utilization of medicinal plants in the traditional methods. Pure compounds allow for better drug dose handling and combination therapy. In addition, by focusing on the main therapeutic molecules, the unwanted effects of thousands of complex molecules in medicinal plants are eliminated. But by determining the structure of pure pharmaceutical compounds, it is possible to manipulate them to improve therapeutic efficiency or reduce the side effects of the drug (Ahmadyousefi, 2023).

Cancer is amongst the main reasons of death leading to high health burden universally as it results to significant cost of management for individuals affected with it (Olatunde et al., 2021). In vitro researches displayed that the plant secondary metabolites in extracts causes

inhibition of cancer cell through DNA mutilation as well as stimulation of apoptosis-tempting enzymes in different models (Chandra et al., 2023).

Anti-oxidant activity, prohibitation of cell cycle, inducement of apoptosis and prevention of angiogenesis were the most anticancer activities. Compounds such as: Vinblastine, vincristine, curcumin, myrtucommulone, taxol, boswellic acids, and umbelliprenin, quercetin, catechin, cucurbitacin, kaempferol, thymol, carvacrol, 1,8-cineole, α-pinene, myrecene, β-sitosterol had anti-cancer acticities (Asadi-Samani et al., 2015).

Results from numerous studies indicated that *Rosa canina* L. owned many biological potencies, including anti-inflammatory, anti-tumor, immunomodulatory, anti-microbial, anti-oxidant, pain reduction, anti-diabetic, anti-hyperlipidemic, neuroprotective, genoprotective, anti-obesity, skin-whitening, and anti-biotic resistance reversal activity as well as exerting a positive influence on the osteoarthritis, anxiety, depression, recognition memory, urinary and reproductive systems disorders, and neutrophil respiratory burst. Nevertheless, the exact mechanism of action for these properties is not fully recognized. Due to the lack of toxicity and side effects, this plant has been considered as a valuable complementary drug for various diseases (Khazaei et al., 2020).

The purpose of this article is to highlight the cultivation of some ornamental plants and their important applications in the production of medicines for the treatment of various diseases, especially cancer, which is currently afflicting many people.

Material and Methods

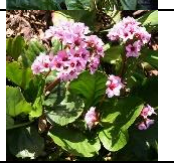
To conduct anti-cancer studies of ornamental plants, the purpose of the study must first be determined, and which plant organ is to be selected for research. Based on pharmacological studies on various plants and known anti-cancer compounds, the desired organ is selected and then taken to the laboratory for extraction using various methods. Various alcoholic extracts are taken from plant organs, and this stage itself can have interesting results, depending on the type of alcohol used in the extraction. For example, in a research on A. parviflora whole plant was subjected to successive Soxhlet method to extract compound using three different solvents; hexane, methanol and aqueous solvent at 70–80°C until solution become colorless (Trivedi et al., 2025). After this step, In-vivo and In-vitro examination start. For example, in a research on anticancer properties of *Alcea rosae* extract The in vitro phase focused on evaluating the anti-inflammatory and anti- colorectal cancer potential of *Alcea rosea* extracts using HCT116, HT29, and SW480 colorectal cancer cell lines. The in vivo phase involved an LPS-induced inflammation model in BALB/c mice (Parry et al., 2023).

Ornamental plants and their compounds for treatment of cancer

Out of the roughly 70,000 plant species believed to possess medicinal properties, more than 3000 demonstrate anticancer activities, creating an expansive pool for the exploration, screening, and application of anticancer drugs (Kuruppu et al., 2019). Some ornamental flowers that have been extensively studied by researchers for their anti-cancer effects are listed in the table 1.

Table 1: Some Anti-cancer flowers and their compositions

Ornamental plants	Anti-cancer composition	Anti-cancer organ	Plant picture
Alcea rosae	kaempferol α-Tocopherol phytol (Parry et al., 2025)	Seed (Parry et al., 2025)	
Aloe vera	Doxorubicin butyl‑p-tolyl sulphide lupeol isobarbaloin 6-methyl-4-chromanone barbaloin, lectin emodin, aloe-emodin aloesinacemannan anthrone-C-glycosides	Leave (Karpagam et al., 2019)	

Ornamental plants	Anti-cancer composition	Anti-cancer organ	Plant picture
	sitasterol alexin-B campesterol butylated hydroxyanisole (Karpagam et al., 2019)		
Catharanthus roseus	Vinblastine Vincristine caffeoylquinic acids quercetin kaempferol isorhamnetin (Goswami et al., 2024)	Leaf Stem Seed Petal (Harshini et al., 2020)	
Euphorbia Milii	p-hyfroxybenzoic acid, vitexicarpin, artemetin, daucosterol, diterpe-nes (Chaman et al., 2019) euphorbetin, aesculetin, kaempferol-3-glucuronide, b-sitosterol, daphnetin (Zhang et al., 2019) lectin (Tonoli et al., 2012) amyrin acetate, cycloartenol,lupeol acetate, flavonoids triterpenes (Zeghad et al., 2016)	Leave Latex of shoot Root (Giri et al., 2024).	
Ajuga parviflora	Ajugin A–F 3,4,17,20,28-Pentahydroxy-1-oxo-(20 R,22 R) Witha-5,24-dienolides 3,17,20-Trihydroxy-1-oxo-(20S,22 R) Witha- 2,5,24-trienolides (Nuan et al., 2019)	Leave (Nuan et al., 2019)	
Taxus bacata	taxane alkaloids	Leave and seed (Milutinović et al., 2015) Trunk Shell	
Amorphophallus campanulatus	Cinnamaldehyde ferulic acid, quercetin and asiatic acid	Rhizome (Khan et al., 2007).	
Bergenia ciliata	Bergenin gallic acid catechin afzelechin (Chauhan et al., 2012)	Rhizome (Chauhan et al., 2012)	
Petasites japonicas	eremophilane-type sesquiterpenoids like petasitesterpenes phenolic acids such as chlorogenic acid bakkenolide-A S-japonin (Kim et al., 2015)	Root (Kim et al., 2015) Leave Rhizome, leaf, petiole (Cho et al., 2023) Leave (Seo et al., 2008)	
Adiantum Venustum	Flavonoids Terpenoids Saponins Phytosterols (Bera et al., 2023; Viral et al., 2011)	Stem Leave (Bera et al., 2023; Viral et al., 2011)	
Camptotheca acuminata	Camptothecin (Behera and Padhi, 2020)	Bark (Behera and Padhi, 2020) Leaf and seed (Zhang et al., 2007)	
Podophyllum peltatum	Podophyllotoxin (Courdavault et al., 2020) Phenyl alanine cinnamic acid ferulic acid (Arthanari, 2020)	Root Rhizome (Courdavault et al., 2020)	

Alcea rosae

Alcea rosea extracts had anti-inflammatory and anticancer effects, if it's metabolites had been pure, it interdicted inflammation-associated colorectal cancer. In vitro analysis divulged that *Alcea rosea* extracts inhibited protein denaturation, nitric oxide production, and membrane hemolysis with IC50 values ranging from 47.46 to 268.46 µg/mL. In vivo, AR-EA and AR-Met extracts attenuated LPS-induced paw edema and restored modify biochemical parameters in mice models, highlighting the extracts' therapeutic potential against swelling associated colorectal cancer (Parry et al., 2025). *A. rosea* hexane extract effectively prevented HuH-7 cell growth by inducing apoptosis. Although it has potential as an anticancer factor, other research is required to evaluate the in vivo anticancer effectiveness (Abutaha et al., 2024).

Aloe vera

Aloe vera is a plant that, in addition to being ornamental, is also used in the food and pharmaceutical industries. The leaves of *A. vera* showed presence of secondary metabolites like doxorubicin, butyl‑p-tolyl sulphide, lupeol isobarbaloin, 6-methyl-4-chromanone, barbaloin, lectin, emodin, aloe-emodin, aloesinacemannan, anthrone-C-glycosides, sitasterol alexin-B, campesterol and butylated hydroxyanisole. Other isolated compounds from *A. vera* leaves were examined against ovarian cancer [OVCAR-3], human colon cancer [HCT-116 and IGROV-1], and breast cancer [MCF-7] cell lines through MTT assay to assess in vitro cytotoxic activity (Karpagam et al., 2019). *Aloe vera* caused growth inhibitory effect in Ehrlich ascites tumour cells, a decrease in DNA synthesis and an accumulation of cells in the G1 phase (Kametani et al., 2007). *Aloe vera* or at least one of its compositions could interrupt the pro-growth signalling pathways of cancer and this is the first time to show the therapeutic effect of *Aloe* on cancer based on biological capabilities of cancer (Manirakiza et al., 2021).

Catharanthus roseus

The methanolic extracts of *C. roseus* exhibited noteworthy anticancer action on the (Hep-2) cell line. These extracts inhibited cells significantly, lowering viable cell count. The MTT assay was used to test the cytotoxicity effect of ethanolic extract of *C. roseus* flower in human epithelial cervical carcinoma cell line (HeLa) (Harshini et al., 2020).

The alkaloids of *C. roseus* showed a wide range of medicinal importance, including antihypertensive, antimicrobial, anti-inflammatory, and anticancer properties. Specifically, Vinblastine and Vincristine, obtained from *C. roseus*, have displayed significant efficacy in the treatment of different cancers, such as: Hodgkin's lymphoma and leukemia, which along with vindesine and vinorelbine are known anti-tumor drugs derived from Chinese traditional medicine (Goswami et al., 2024).

Euphorbia Milii

Chloroform extracts of the plant exhibit cytotoxic effects on cancer cell lines like HepG2 (liver cancer cells). These effects are thought to arise from the plant's ability to induce apoptosis and inhibit the growth of cancer cells. Additionally, molecular docking studies suggest that some bioactive compounds target key enzymes involved in cancer cell proliferation, such as cyclin-dependent kinase 2 (CDK2) (Bani et al., 2008). The dose inhibition curve and IC50 value 137.89µg/mL of petroleum ether extract of *E. milii* leaves, had maximum free radical scavenging activity due to the crude nature of the extract, considering it as a sign of possessing potential antioxidant property (Giri et al., 2024). Antioxidant &anti- inflammatory properties in *Euphorbia dendroides* (Smeriglio et al., 2021) using RP-LC-DAD-EMI-MS analysis. Anticancerous and antioxidant property from *Euphorbia milii* by lowering the reactive oxygen species which caused the apoptosis (Sagar and Bisht, 2021). The phytoconstituents discovered in the flower extracts of *E. milii* may possibly be responsible for the antioxidant activities and metal binding ability (Kaur et al., 2023).

Ajuga parviflora

This plant cultivated as an ornamental (groundcover) and medicinal plant. The cytotoxicity action of aqueous and methanol extracts from A. parviflora leaves was explored against leukaemia murine [L-1210] and human chronic myelogenous leukaemia [K-562] cell lines (Aknit et al., 2019). Reverse phase High Performance Liquid Chromatography analysis declared and quantified two cominations i. e. Rutin (1.48 %) and quercetin (1.82 %). Liquid

Chromatography-Mass Spectrometry analysis identified seventeen secondary metabolites as major and minor phenolics, flavanoids of methanolic extract. Hence, our finding proves *A. parviflora* whole plant of methanolic extract might be used as potential antioxidant, anti-inflammatory and anticancer drugs (Trivedi et al., 2025). Specific withanolides, which are characteristic of Solanaceous plants, have been identified, including: Ajugin A–F, 3,4,17,20,28-Pentahydroxy-1-oxo-(20 R,22 R) Witha-5,24-dienolides, 3,17,20-Trihydroxy-1-oxo-(20S,22 R) Witha- 2,5,24-trienolides etc. Other notable secondary metabolites include phenolics and flavonoids such as coumaroyl glycosides, apigenin, luteolin, luteolin glycoside, and caffeic acid. This comprehensive phytochemical profile underscores Ajuga's potential as a valuable resource for developing plant-based treatments for inflammation, cancer, and other health conditions (Nuan et al., 2019).

Taxus bacata

have anticancer, antimalarial, antiparasitic, antifungal, analgesic, antibacterial, anti-inflammatory, antimicrobial, anti-nocieptive, aphrodisiac, antipyretic, antirheumatic, anti-spasmodic, antioxidant, anticonvulsance effects (Ankit et al., 2019). In vitro and in vivo researches exposed that oridonin persuades apoptosis in a wide range of cancer, including hepatocellular, cutaneous, colorectal, gallbladder, breast, gastric, and pancreatic malignancies. The MTT test was used to assess the cytotoxicity of *T. bacata* aqueous and aqueous methanol extracts against human colon cancer (HCT-116) cell lines (Milena et al., 2015). Microscopic examination indicated that the extracts induced apoptosis in both cell lines. These results suggest that T. baccata leaves and seed cones are a potential source of phenolic compounds, especially flavonoids, as natural antioxidant, cytotoxic and strong proapoptotic substances of high value (Milutinović et al., 2015).

Amorphophallus campanulatus

A pronounced results of cytotoxic and apoptotic activities were observed in the cells treated with 5-FU and CHF, whereas, EAF and MeF treated cells exhibited a moderate result and the least effect were observed in PEF treated cells. Furthermore, these findings confirm that the sub fractions of ACME dose-dependently suppress the proliferation of PLC/PRF/5 cells by inducing apoptosis (Ansil et al., 2014). It is introduced that rhizome of *Amorphophallus campanulatus* possesses an antibacterial, antifungal and cytotoxic activities (Khan et al., 2007).

Bergenia ciliata

Potential drugs that used against tumors for chemoprevention or chemotherapy are derived from Bergenia ciliate rhizome, methanolic and aqueous extract (Chauhan et al., 2012). *B. ciliatahave* potential to work against neoplastic activities due to which it acts as defensive medicine (Bhandari et al., 2008). The results indicate that *B. ciliata* has strong anti-cancer activities because of its capability to moderate UPR and ROS pathways. precisely, the plant extract effectively suppresses the cytoprotective UPR by blocking IRE1-Xbp1 and ATF6 pathways while increasing the PERK-ATF4-CHOP pathway, which is known to switch UPR towards apoptosis. These researches conclusively submit that BcME works synergistically on both UPR and ROS pathways to promote apoptosis and eliminate cancerous cells and thus serves as a potential primary source for bioactive molecules, selectively targeting cancer cells (Qadri et al., 2023).

Petasites japonicas

methanolic extract of *Petasites japonicus* was used to reduce the cell capability. The growth of Hep3B HCC cells through inhibiting the Akt/mTOR and Wnt signaling pathways is inhibited by methanol extract of *Petasites japonicus* and suggested as an anticancerous on Hep3B HCC cells (Kim et al., 2015). The anticancer results with the extracts of butterbur were tested by breaking down into parts with various solvents. 41.9% of the growth of stomach cancer cells, SNU-719, were inhibited and also 72.7% of the growth of liver cancer cells, Hep3B, were inhibited by the butanol fractions of butterbur, whereas normal cell didn't change (Seo et al., 2008). The IC50 values of hexane extracts from leaves and rhizomes against AGS, HepG2, and MCF-7 human cell lines were greater than those of other extracts, while ethyl acetate extracts from petioles showed higher significant effect for all cell lines. Hexane and EtOAc extracts exerted their antiproliferative activity in four cancer cell lines. In general, the researches

indicate that *P. japonicus* has the potential to be developed into selective anticancer nutraceutical and/or pharmaceutical treatments with low cost (Cho et al., 2023).

Adiantum Venustum

Flavonoids, terpenoids, saponins, and phytosterols from the stem and leaves of *Adiantum venustum* have anticancer potential and can be used for the treatment of cancer (Bera et al., 2023). The research indicates that ethanolic extract of *A. venustum* Don possesses significant anticancer activity and also reduces elevated level of lipid peroxidation due to the presence of terpenoids and flavonoids. Thus, ethanolic extract of *A. venustum* Don could have vast therapeutic application against cancer (Viral et al., 2011). The results of a research indicated that ethanolic extract of

Adiantum venustum Don has significant anticancer activity and also degrade elevated balance of lipid peroxidation due to higher amount of terpenoids and flavonoids. Thus ethanolic extract of *Adiantum venustum* Don could have waste therapeutic usage in treatment of cancer (Devmurari, et al., 2011).

Camptotheca acuminate

Irinotecan is a chemotherapy drug derived from natural compound camptothecin that impedes topoisomerase 1. Camptothecin was discovered and isolated from the bark of the Chinese happy tree (*Camptotheca acuminate*) (Behera and Padhi, 2020). Seed extract contained all the three alkaloids whereas leaf extract was invisible of HCPT. A strong proporion of the three alkaloids was found however it was related upon seed or leaf extract of *C. acuminata*, which with different compositions can be produced. Ecological and medicinal implications of the leaf and seed extract characterized with different chemical compositions are discussed (Zhang et al., 2007). Compounds, especially 10-hydroxycamptothecin from *Camptotheca acuminata*, Cyclocurcumin from Curcuma longa, and Diphyllin from Diphylleia grayi, have the minor binding energies of -7.62 kcal/mol, -7.41 kcal/mol, and -7.99 kcal/mol, respectively, which can prevent the receptor (Gurjar et al., 2024).

Podophyllum peltatum

Etoposide and teniposide are lignin derivative compositions widely applicated in chemotherapy for testicular cancer, lung cancer, lymphoma, leukemia, neuroblastoma, and ovarian cancer. At present, both of these drugs are obtained by chemical conversions of the podophyllotoxin skeleton, a lignan that accumulates at low levels in the roots of Mayapple plant (Courdavault et al., 2020). Some compositions such as:Phenyl alanine, cinnamic acid, ferulic acid from *Podophyllum Peltatum* L were used in the synthesis of podophyllotoxin. It binds and desroy microtubule polymerization which stops cell cycle and damages DNA. Endoplasmic reticulum stress and autophagy was caused due to cell death by podophyllotoxin (Arthanari, 2020).

Conclusion

Research shows that ornamental flowers, in addition to their aesthetic uses, can be used as a medicinal plant in the production of drugs to treat various diseases, especially cancer, which has become widespread in recent years. The production of some chemical anticancer drugs, in addition to their high cost, may have other adverse effects on human health. Research on the anticancer medicinal effects of ornamental plants can be a step towards using safe plant resources for human health, eliminating the need for chemical products, reducing costs, and even producing these products for export. The above research shows that ornamental plants have extensive applications and excellent results in treating various types of cancer in humans. Hopefully, with more extensive research, we can produce cheaper medicines for cancer patients.

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Declaration

Authors have no conflict of interest to declare.

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