



ANTICANCER PROPERTIES OF SOME ORNAMENTAL PLANTS ON KNUST CAMPUS, KUMASI, GHANA

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ABSTRACT

Ornamental plants are plants which are mainly grown for their aesthetic value, however there are many ornamental plants that have medicinal uses as well. On Kwame Nkrumah University of Science and Technology (KNUST) campus, many ornamental plants have been identified on the campus as having medicinal properties, with special attention being centred on the plants with antitumour or anticancer properties. This paper sought to identify ornamental plants with anticancer and antitumour effect and contents indentified. The paper reviewed the following plants which were identified; *Belamcanda chinensis*, *Codiaeum variegatum*, *Catharanthus roseus* and *Nerium oleander*. It is hoped that this review will lead scientists into identifying the active principles, activity and safety of these ornamental plants.

Key words: Anticancer, *Belamcanda chinensis*, *Catharanthus roseus*, *Codiaeumvariegatum*, *Nerium oleander*.

INTRODUCTION

Cancer is a disease that kills hundreds of people daily all over the globe. Over the years, there have been many chemotherapy drugs that have been administered to these patients, though these come with numerous side effects. The number of patients seeking herbal therapy grows each and every day. Herbal medicines are now in great demand in the developing world for primary health care. This is because they are less expensive, are more compatible with the human body and also due to their minimal side effects (Thamotharan *et al.*, 2013). Free radicals play a role in the aetiology of several major diseases including diabetes, cancer, atherosclerosis, Parkinsonism and aging (Thamotharan *et al.*, 2013). The presence of phytochemicals found in plants such as the ornamentals, can go a long way in treating many of these diseases we find around us. Since there are so many ornamental plants around us, it is necessary that we have in-depth knowledge on the properties they possess medicinally. This can then serve both the purpose of obtaining herbal therapy, and at the same time putting

waste into good use, when it is time for the plants to be pruned. This paper identified four ornamental plants on KNUST with anticancer or antitumour effects and presents a literature review on description, phytochemicals identified and anticancer or antitumour studies performed. Summary of identified plants are as shown in Table 1.

Belamcanda chinensis (L.) DC



Belamcanda chinensis popularly known as Leopard lily, from the Iridaceae family is a shrub native to the south western part of China, more especially in the provinces of Guizhou, Yunnan, and Sichuan. It is a perennial herbaceous plant with fan-shaped leaves that

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has a maximum length of 2 to 3 feet on its branching stems (Liu *et al.*, 2012a). The root of *B. Chinensis* is widely used in China for curing pulmonary diseases, acute and chronic pharyngitis, asthma and cancer. In 2005, the Chinese Pharmacopoeia listed *B. Chinensis* as an official drug, which could be used as an anticancer herb (Liu *et al.*, 2012a). It has been reported that petroleum ether, ethyl acetate and methanol extracts of the plant root exhibited significant antitumour activity against PC3, Bcap-37 and BGC-823 cells lines (Liu *et al.*, 2012b). Altogether, eighteen different compounds were isolated. Some of the compounds isolated were gallic acid, irisfloreantin, botulin, dausterol, ursolic acid, quercetin, betulone, shikimic acid, betulonic acid, tectoridin and kampferol. The ethyl acetate extract showed moderate antitumor activity against PC3, MGC-803, Bcap-37 and MCF-7 cell lines, and this was as a result of the pentacyclic triterpene constituents present (Liu *et al.*, 2012b). Plant constituents have also been shown to be anticancer Drugs by regulation of aberrant expression of genes relevant in proliferation, invasion,

immortalization and apoptosis in LNCaP prostate cancer cell lines (Thelen *et al.*, 2005).

Three phenolic compounds have been isolated from the rhizome, belalloside A, belalloside B and belamphenone, and evaluated for their cell proliferation stimulatory activity against MCF-7 and T-47D human breast cancer cell lines. These and other compounds were shown to possess varying degrees of stimulatory activities (Monthakantirat *et al.*, 2005). Also, the viability of the human hepatocellular carcinoma (HCC) HepG2 cells treated with tectorigenin isolated from *B. chinensis* decreased in a concentration - and time-dependent manner by apoptosis mainly via mitochondrial-mediated pathway and produces a slight cytotoxicity to L02 cells (Jiang *et al.*, 2012). Morrissey *et al.*, (2004) also demonstrated that phytoestrogen, irrigenin and tectorigenin, inhibited proliferation of three human prostate cancer cell lines (RWPE-1, LNCaP and PC-3) by inducing G1 arrest and p21WAF1 or p27 protein expression indicating its ability to inhibit proliferation of prostate cancer.

Table 1. Identified ornamental plants on KNUST campus with anticancer and antitumour activity

Name of Plant	Family Name	Part Used	Cancer Effect	Reference
<i>Belamcanda chinensis</i>	Iridaceae	Root	PC3, MGC-803, Bcap-37, MCF-7 cell lines	Liu <i>et al.</i> , 2005ab
		Root	LNCaP	Thelen <i>et al.</i> , 2005
		Rhizome	MCF-7 and T-47D	Monthakantirat <i>et al.</i> , 2005
		Rhizome	HepG2	Jiang <i>et al.</i> , 2012
		Rhizome	RWPE-1, LNCaP and PC-3	Morrissey <i>et al.</i> , 2004
<i>Catharanthus roseus</i>	Apocynaceae	Stem and leaves	Leukemia in children Hodgkins disease T47D	Sain and Sharma, 2013
		Aerials and root	Jurkat	Widowatiet <i>et al.</i> , 2013
		Leaves	HCT-116	Ahmad <i>et al.</i> , 2010
		Leaves Leaves	9KB (nasopharynx) and P-338 lymphocytic leukaemia	Siddiquiet <i>et al.</i> , 2010 Mukhapadhyay and Cordell, 1981
<i>Codiaeum variegatum</i>	Euphorbiaceae	Leaves	HepG2, MCF 7, HCT116, and A549	Hassan <i>et al.</i> , 2013
<i>Nerium oleander</i>	Apocynaceae	Leaves and flowers	A549 lung cancer cells	Calderón-Montano <i>et al.</i> , 2013
			PC3 and DU145	Smith <i>et al.</i> , 2001
			T ₄₇ D, HepG2 and K562	Namianet <i>et al.</i> , 2013
			L ₂₀ B	Al-Obaidi, 2014

***Catharanthus roseus* (L.) G. Don**

The Madagascar periwinkle, is botanically known as *Catharanthus roseus*, *Vinca rosea* or *Lochnera rosea*. It is from the family Apocynaceae and was originally a species native to Madagascar. Other English or common names used for the plant include Cape Periwinkle, Rose Periwinkle and Rosy Periwinkle, among others. The plant grows widely to about 1m tall at subtropical areas. Its leaves are found to be of oval to oblong, 2.5 – 9.0 cm long and 1.0- 3.5 cm broad, glossy green, hairless, with a pale midrib and a short petiole of about 1.0- 1.8 cm long and they are arranged in the opposite pairs (Gajalakshmi *et al.*, 2013). The plant is an erect, ever blooming herb or subshrub with either pink or white flowers. Its main reason for being cultivated is to serve as an ornamental plant in gardens throughout the world. In addition to its beautification purposes, *Catharanthus roseus* serves an important medicinal plant and may also be cultivated mainly for its alkaloids, which possess anticancer activities (Patil and Ghosh, 2010). Apart from its anticancer properties, *Catharanthus roseus* possesses known antibacterial, antifungal, antidiabetic, and antiviral activities as well. The plant has been demonstrated to contain various alkaloids, such as vincristine, vinblastine, and yohimbine among others. The role of the vincristine or veurocristine is to bind to tubulin dimers which would inhibit the assembly of microtubule structures in cancer progression (Negris, 2011). Disruption of the microtubules arrests mitosis in metaphase. The vinca alkaloids therefore affect all rapidly dividing cell types including cancer cells thus killing these cells and curing the cancer found in the body. Vinblastine as an antimicrotubule drug may also be used in treating certain kinds of cancer (Svoboda, 1983). The anticancer alkaloids Vinblastine and Vincristine are derived from stem and leaf of *Catharanthus roseus*. These alkaloids have growth inhibition effect on some human tumors. Vinblastine is used for the treatment of neoplasms and is recommended for Hodgkins disease as well. Vincristine, the other alkaloid could also be used for treating Leukemia in children (Sain and Sharma, 2013). Widowati *et al.*, (2013) has demonstrated that methanol extracts of aerial and roots of *C. roseus* reduced the proliferation of the human ductal breast epithelial tumour

cell lines (T47D) with a mean IC₅₀ of 2.8% by apoptosis. Also, aqueous extract of leaves induced cell death of human leukemic T-cells (Jurkat) in a time – and dose – dependent manner with mean IC₅₀ value of 2.38 µg/ml by DNA fragmentation (Ahmad *et al.*, 2010). Preliminary cytotoxicity study has demonstrated further a dose-independent activity of methanol extracts of *C. roseus* against HCT-116 colorectal carcinoma cell lines at 200 µg/ml (Siddiqui *et al.*, 2010). Other studies has shown the role of vindoline extract of *C. roseus* to be cytotoxic against Eagle's 9KB carcinoma of nasopharynx and the P-338 lymphocytic leukemia (Mukhapadhyay and Cordell, 1981).

***Codiaeum variegatum* (L.) A.Juss**

Codiaeum variegatum, commonly known as Croton or Joseph's coat, is a shrub from the family Euphorbiaceae and is originally found in the South Eastern Asian countries; Indonesia, Malaysia, Philippines, India, Thailand and Sri Lanka. It is an evergreen plant that can reach a maximum height of 6 m, but it is usually allowed to grow to a height between 60 and 90 cm (Nasib *et al.*, 2008). There are many different species of croton that can be found worldwide, with some varying in their shapes, sizes and colour combinations. The young leaves of this plant are usually green, yellow, red or bronze and they later change to pink, maroon, gold, scarlet, cream, purple, black, brown or white, as they mature (Nasib *et al.*, 2008).

Croton is known to produce secondary metabolites such as flavonoids, terpenes and alkaloids. Apart from the aesthetic purposes of *Codiaeum variegatum*, it is also known to have medicinal uses. These include being used as a purgative and a sedative. Croton in addition, also has antifungal, antiamoebic and anticancerous activities. The cytotoxicity of methanol extracts and isolated alkaloids of leaves of *C. variagatum* CV. *petra* were evaluated against hepatocellular carcinoma cell line (HepG2), human Caucasian breast adenocarcinoma (MCF7), colon cell line (HCT116) and lung carcinon cell line (A549) and proved to be active with activity range of 17.3% - 98% (Hassan *et al.*, 2013). However, in Malaysian cultivars, tumour-promotor activity was observed at lower concentrations of 0.2 – 1.2 µg/ml in human lymphoblastoid cell line harbouring the

Epstein-Barr virus (EBV) genome, suggesting the needed attention from the regular users of the plant (Norhanom and Yadav, 1995).

Nerium oleander (L.)



This plant is commonly known as Arali (Tam) (Gupta and Mittal, 2010). It belongs to the family Apocynaceae which is also commonly known as Gandeera. The plant has its leaves arranged in threes, and they could grow to lengths between 10 and 15 cm for each leaf. They are linear lanceolate in shape, have a dark green shiny surface, and usually have a short stalk. The flower is most often white or rose in colour. Its petals measure 3.8 cm in diameter, and they are fragrant with rounded lobes. The filamentous parts of the flower are hairy whereas its follicles are 15 to 23 cm long (Hussain and Gorski, 2004). This plant is commonly found in Nepal, China, Japan, and a greater part of India. It is cultivated in Ghana for ornamental purposes. Though an ornamental plant, the roots, bark and leaves of Arali serve many important medicinal purposes. The roots serve as an aphrodisiac, as a tonic, for chronic pain in the abdomen and is also used to soothe pain in the joints (Suganya *et al.*, 2012). Again, the extract of the plant could be ingested, and used in the treatment of cancer, and as a cardiotoxic. The plant could also be ground and used externally to treat leprosy and skin diseases (Gupta and Mittal, 2010).

Despite its entire importance *N. oleander* can be a very poisonous plant, and can cause death in some

cases. The toxicity of the plant can be found in all parts of the plant but most especially, it is concentrated in the sap. These toxins are cardiac glycosides, and the two most common are oleandrine and nerine. These act by blocking out the receptors in the skin, thus causing numbness (Bhuvaneshwari *et al.*, 2007).

Nerium oleander possesses important pharmacological activities such as antinociceptive, anti-inflammatory, antibacterial, anticancer and CNS depressant activity. The methanolic extracts of the leaves and flowers of the plant has shown anti-inflammatory activity, anticancer activity and cell growth inhibitory activity (Zhong *et al.*, 2005). The major active compound in *N. oleander* that is used in fighting cancer is a cardiac glycoside, known as oleandrin. Anvitzel and oleandrin has shown inhibitory activity on fibroblast growth factor - 2 (FGF-2) export *in vitro* from PC3 and DU145 prostate cancer cells in concentration- and time-dependent manner and this contributes to antitumour activity of the plant (Smith *et al.*, 2001). n-Hexane, dichloromethane and methanol extracts of leaves and flowers of *N. oleander* has shown cytotoxic effect on human breast cancer (T47D), human hepatocellular carcinoma (HepG2) and human chronic myeloid leukaemia (K562) cell lines with IC₅₀ values ranging 57.77 and 277.43 µg/ml. Morphological studies of treated cells indicated that cytotoxic effect of oleandrin comes about by inducing apoptotic death (Namian *et al.*, 2013). Other studies with aqueous and ethanolic leaf extracts has shown cytotoxicity on mice transformed cell lines (L₂₀B) with inhibition range of 28 and 73% (Al-Obaidi, 2014).

CONCLUSION

It is evident that ornamentals have more use than just decorative purposes. It is therefore necessary that more research is carried out into these plants. More especially, their individual phytochemicals could be extracted and used to cure tumours as indicated in literature.

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