



A Database of Anti-Diabetic and Anti-Cancer Plant Species from the Family Euphorbiaceae

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Abstract: The Euphorbiaceae family has a broad distribution. This genus plants have been used in traditional medicine for a long time. Alkanes, triterpenes, phytosterols, tannins, polyphenols, and flavanoids are the key active ingredients that are thought to be responsible for various forms of operation. Members are found all over the world, and include both old and new world plants, some of which have yet to be discovered. This study provides useful and significant data for identification of different plants in Euphorbiaceae family that are extensively used as remedies against diseases and complaints such as cancer and diabetes, two most common malady to mankind.

[Reshmina Firoz Khan, Ram P. Yadav and Ajay Singh. **A Database of Anti-Diabetic and Anti-Cancer Plant Species from the Family Euphorbiaceae**. *Cancer Biology* 2021;11(4):110-115]. ISSN: 2150-1041 (print); ISSN: 2150-105X (online). <http://www.cancerbio.net> 5. doi:[10.7537/marscbj110421.05](https://doi.org/10.7537/marscbj110421.05).

Keywords: Euphorbiaceae, anti-cancer, anti-diabetic, phytochemicals

Introduction

The WHO consultative body on medicinal plants has described medicinal plants as “any plant that contains substances that can be used for therapeutic purposes or that is a precursor for the synthesis of useful drugs” in one or more of its organs [1]. Natural products, particularly medicinal plants, have played an important role in the development of therapeutic agents and drug discovery. Many biologically active compounds found in plants have the potential to be developed into therapeutic agents. Increased focus on the use of plant products as a source of medicines for a wide range of human diseases has resulted from population growth, inadequate medication supply, unaffordable treatment costs, side effects of many allopathic medications, and the emergence of resistance to commonly used drugs for human diseases [2].

Medicinal plants, also known as medicinal herbs, are a diverse group of plants used in herbalism, some of which have medicinal properties. These medicinal plants are thought to be a valuable source of ingredients for drug production and synthesis [3]. Natural products derived from conventional medicines are extremely important to society. The modern drug development process is aided by modern concepts and methodologies, which include several clinical trials, a unique variety of chemical structures, and biological activities. Medicinal plants have traditionally produced novel drug compounds and medicines that have made significant contributions to many societies' health needs.

Main parts

Phytochemistry is the analysis of phytochemicals formed by plants, and it describes the isolation, purification, identification, and structure of the many secondary metabolic compounds found in plants [4]. The phytochemicals present in the plants, also called secondary metabolites like, flavonoids, alkaloids, tannins, glycosides and steroids etc. are responsible for the therapeutic properties of the medicinal plants. As a result, there is a need to look inwards to find herbal medicinal plants with the goal of validating ethanomedicinal use and then isolating and characterizing compounds that will be applied to possible drug lists.

The spurge family Euphorbiaceae includes about 7500 species and 275 genera of flowering plants that are mostly found in the tropics. Ethnomedicine in the Euphorbiaceae family is highly complicated. The bulk of the members are toxic due to the presence of a wide range of unusual secondary metabolites [5]. On the contrary some of the participants are highly beneficial.

The various species of the Euphorbiaceae family have been reported to have cytotoxic, hepatoprotective, antispasmodic, anti-inflammatory, antibacterial, antifungal, anti-mutagenic, antiviral, pesticide, molluscicidal and larvicidal activities. Surprisingly, various extracts from these euphorbiaceous plants have been shown to have anti-diabetic and anti-cancer properties. Local communities in many

countries have used euphorbiaceae species in traditional medicine to treat a variety of ailments. For example, *Acalypha Indica* plants can help with bronchitis, pneumonia, asthma, and pulmonary tuberculosis by acting as an emetic, expectorant, laxative and diuretic [6]. Flowers of *Acalypha hispida* are boiled in water or given as a preserve to treat diarrhoea and other related ailments while the flowers show anti-inflammatory and antioxidant activity [7]. The fresh plant of *Euphorbia Thymifolia* is used in ophthalmia and other eye troubles, sores, atrophy, dysentery, bronchial asthma and breast pain, while the leaves and seeds are used as astringent, stimulant, anthelmintic, and laxative [8]. *Euphorbia neriifolia* is found to be effective in abdominal troubles, bronchitis, tumors, inflammation, enlargement of spleen, anemia, ulcers, fever and even in chronic respiratory troubles [9]. Antibacterial, anti-amoebic, anti-fungal, antiviral, spasmolytic, anti-diarrheal, sedative, analgesic, anti-pyretic, anti-inflammatory, anti-malarial, and anti-hypertensive properties have also been identified for the entire *Euphorbia hirta* plant [10,11]. Seed oil of *Ricinus communis* is a potent purgative and it is used externally as a massage for rheumatic pains, joint pain, and paralysis, as well as internally to relieve constipation [12]. *Phyllanthus niruri* has a number of therapeutic properties, including antiviral, antimicrobial, antihepatic, antitumor and antidiabetic properties [13]. *Euphorbia tirucalli* exhibits antibacterial and antiherpetic activity and is also effective against anti-mutagenic warts, cancer, gonorrhoea, arthritis, asthma, cough, earache, neuralgia, rheumatism, toothache, and tumours [14,15]. Leaves of *Croton bonplandianum* is found effective in treatment of high blood pressure, skin diseases and cut, wounds, antiseptic and as antidote [16]. Fruits of *Embllica officinalis* is used in diuretic, diarrhoea, dysentery, anaemia, jaundice and cough [17].

Diabetes mellitus is a group of metabolic diseases marked by chronic hyperglycemia caused by hypo secretion of insulin. Diabetes mellitus is rising to an alarming epidemic level and is so the most common endocrine condition which is affecting more than 150 million people around the world. Synthetic anti-diabetic drugs may have significant side effects and should not be used during pregnancy. Traditional antidiabetic plants should be explored because of the side effects associated with synthetic drugs and because natural medicine is safer, cheaper and more reliable.

Cancer is a term used to describe a group of diseases characterized by uncontrolled growth and spread of abnormal cells as a result of a series of genetic changes that result in the loss of normal growth controls, resulting in uncontrolled growth, lack of differentiation, apoptosis, genomic instability and metastasis. Medicinal plants alleviate and cure cancer by using antioxidant and anticancer compounds that are known to suppress or destroy carcinogenic cells. Certain plants can also contain properties that naturally have the potential to prevent the spread or risk of developing different types of cancer.

The abundance of medicinal plant variety of the family euphorbiaceae, for the management of diabetes and potential cancer treatment has been highlighted in this study.

Plants having Anti - Diabetic activity

Euphorbia hirta

Euphorbia hirta is a plant that often serves as a medicinal herb. Tropical and temperate regions of the world, as well as India, Bangladesh, Africa, and Australia, are home to these medicinal herbs. Its sap contains a wide range of chemical compounds flavonoids, steroid, alkaloids, tannins and saponins that are responsible for the plant's biological function. In streptozotocin-induced diabetic mice, *Euphorbia hirta* extracts have shown strong anti hyperglycemic activity. The antidiabetic activity of ethanolic extracts (250 and 500 mg/kg) of leaf, herb and stem was investigated in normal and streptozotocin (STZ) induced diabetic mice. Blood glucose levels were significantly reduced after taking the extracts orally for 21 days [18].

Aporosa lindleyana

Aporosa lindleyana traditionally used as medicine for healing skin diseases. In both normal and alloxan-induced diabetic rats, the hypoglycemic effect of aqueous and alcoholic extracts of *Aporosa lindleyana* root has been examined. After the procedure blood glucose levels were tested at 0, 1, 2, and 3 hours. The aqueous and alcoholic extracts of *A. lindleyana* (100 mg/kg) significantly decreased blood glucose levels in normal rats from 80.4±2.7 to 69.8±2.0 mg percent and 82.6±1.9 to 70.8±3.2 mg percent, respectively, 3 hours after oral administration of the extract (P<0.001), as well as in alloxan-induced diabetic rats from 306±3.337 to 160±2.46 and 328±4.15 to 152±3.86 mg percent respectively [19].

Table 1. Medicinal properties of some plants of family Euphorbiaceae.

S. No	Botanical names	Plant parts used	Chemical components	Reported activities / Effective against	References
1.	<i>Acalypha Indica</i> L	Leaves, stems, flowers	Alkaloids, phenolic, tannin compounds, flavanoids, saponin, steroids	bronchitis, pneumonia, asthma, and pulmonary tuberculosis by acting as an emetic, expectorant, laxative, and diuretic	[6]
2.	<i>Acalypha Hispida</i> Burm. F	Whole plant, flowers	Alkaloids, catachols, phenols, flavanoids, steroids and tannin.	Diarrhoea, anti-inflammatory, antioxidant activity.	[7]
3	<i>Euphorbia Thymifolia</i> L	Leaves, flowers roots, and whole plant.	Taraxerol β -amyrin, β sitosterol, , kaempferol, cholesterol, salicylic acidesters, n-alkanes, sterol, glycoside	ophthalmia and other eye troubles, sores, atrophy, dysentery, bronchial asthma and breast pain, while the leaves and seeds are used as astringent, stimulant, anthelmintic, and laxative.	[8]
4	<i>Euphorbia nerifolia</i> Linn	Whole plant.	Nerifoliol, quercetin, Taraxerol β -amyrin, sterol	abdominal troubles, bronchitis, tumors, inflammation, enlargement of spleen, anemia, ulcers, fever and even in chronic respiratory troubles	[9]
5	<i>Euphorbia hirta</i>	Leaves, stem and roots and flower	Quercitrin, myricitrin, quercetin, leucocyanidin, quercitol, friedelin, kaempferol, maleic acid, tartaric acid, rutin, α -amyrin.	Antibacterial, anti-amoebic, anti-fungal, antiviral, spasmolytic, anti-diarrheal, sedative, analgesic, anti-pyretic, anti inflammatory, anti-malarial, and anti-hypertensive properties	[10] [11]
6	<i>Ricinus communis</i> L	Whole plant, leaves, flowers, fruits and seeds.	Quercitrin-3-O-galactoside, Linoleic, Ricinoleic, Dihydroxy stearic acid, Unsaturated and Saturated fatty acid	rheumatic pains, joint pain, and paralysis, constipation, antibacterial activity, antimicrobial activity, analgesic activity, catalytic activity, larvicidal activity	[12]
7	<i>Phyllanthus niruri</i>	Leaves, whole plant	flavonoids, tannins, lignans, alkaloids, triterpenes, polyphenols and sterols	antiviral, antimicrobial, antihepatic, antitumor, and antidiabetic	[13]
8	<i>Euphorbia tirucalli</i>	Stem, latex	phenolics and terpenes, euphol and tirucallol	exhibits antibacterial and antiherpetic activity, and is also effective against anti-mutagenic warts, cancer, gonorrhoea, arthritis, asthma, cough, earache, neuralgia, rheumatism, toothache, and tumours	[14] [15]
9	<i>Croton bonplandianum</i>	Leaves, fruits, flowers	alkaloids, 1-Dodecene, 1-Dodecanol, 1-Tetradecene, terpenoids, flavonoids, tannins, steroids	High blood pressure, for the treatment of skin diseases and cut, wounds, antiarthritic, antiseptic and antidote, hypocholesterolemic, nematocide, hepatoprotective	[16]
10	<i>Emblica officinalis</i>	fruits	Alkaloids, phenolic, tannin compounds, flavanoids, saponin	Acrid, cooling, refrigerant diuretic, used in diarrhoea, dysentery, anaemia, jaundice and cough	[17]

Securinega virosa

The goal of the study was to see if a methanol extract of *Securinega virosa* leaves could lower blood sugar levels in streptozocin-induced diabetic rats. The extract was given in three doses (100, 300, and 500 mg) intraperitoneally (at doses of 600 mg/kg and 800 mg/kg, respectively). The blood glucose levels in all three doses of the extract did not alter significantly after 2 hours of administration. There was also a substantial ($P < 0.05 - 0.001$) drop in blood glucose levels after 4, 8, and 24 hours of extract administration in all three dosages of the extract. Reducing sugars, cardiac glycosides, resin, tannins, saponins, glycosides, flavonoids, glycerin, glucose, anthraquinone, and steroids were found in the early phytochemical screening [20].

Jatropha gossypifolia

To test the plant *Jatropha gossypifolia*'s ability to inhibit the enzymes-glucosidase and -chymotrypsin as a potential diabetic treatment different extracts and fractions of the root, leaf and stem bark of the plant were screened for their α -glucosidase and α -chymotrypsin inhibitory activity using standard *in vitro* inhibition assays. The enzyme inhibition for glucosidase was highest in the n-butanol and ethyl acetate fractions, with 67.93 ± 0.66 and 67.67 ± 0.71 percent and half maximal concentrations (IC_{50}) of 218.47 ± 0.23 and 213.45 ± 0.12 g/ml respectively. The existence of bioactive secondary metabolites with enzyme-inhibitory action supports the plant's historic usage in the treatment of diabetes and ulcers. However, more research on the plant is needed, including the identification of its active components [21].

Euphorbia prostrata

In alloxan-induced diabetic rabbits (150mg/Kg) serum biochemical parameters were investigated in whole plant (methanolic extract) of *Euphorbia prostrata* (EP) (250 and 500 mg/Kg/day per oral for 14 days). The typical anti-diabetic medicine was glibenclamide (5 mg/kg/day per oral for 14 days). When compared to the control group alloxan-induced diabetics had higher fasting blood glucose, cholesterol and triglyceride levels. *Euphorbia prostrata* extract (at dosages of 250 and 500 mg/kg) had an anti-diabetic effect, lowering fasting blood glucose levels significantly. In comparison to the 250 mg/Kg dose of *Euphorbia prostrata*, the 500 mg/Kg dose yielded more significant ($P < 0.05$) outcomes. At the end of the research, the levels of serum cholesterol and triglycerides were also reduced [22].

Plants Having Anti-Cancer Property

Excoecaria agallocha

The anti-HIV and anticancer properties of *Excoecaria agallocha* belong to family euphorbiaceae using active fraction of stem ethanol extracts were investigated, and they were found to have significant anti-reverse transcriptase activity in the enzyme-based direct binding assay, which was comparable to that of the standard synthetic inhibitor. MTS *in vitro* assay was used to test the anticancer activity of the same fraction. With IC_{50} values of 4 g/ml and 7 g/ml, it displayed strong cytotoxicity against the pancreatic cancer cell lines Capan-1 and MiaPaca-2 [23].

Leptopus lolonum

The complete plants of *Leptopus lolonum* yielded nine new phenylpropanoid-conjugated pentacyclic triterpenoids, as well as twenty-two recognized compounds. HRESIMS and 1D/2D NMR data indisputably revealed the structures of these novel molecules. HepG2, MCF-7, A549, and He La cancer cell lines were used to test all triterpenoids for their cytotoxic properties. The triterpenoid with a phenylpropanoid unit showed increased cytotoxicity on cancer cells among these isolates, suggesting that the phenylpropanoid moiety is important [24].

***Phyllanthus niruri* Linn**

Phyllanthus niruri is a traditional medicine that is thought to have anticancer properties. Granzyme, a serine protease generated by cytotoxic-T lymphocytes (CTLs) and natural killer cells (NK cells) has been proposed as a cancer prognostic marker. *In vitro* study exhibited that *Phyllanthus niruri* extract inhibited the growth of colorectal cancer cells on experimental rats [25]. A study showed that *Phyllanthus niruri* extract could arrest hepatic carcinoma cell line, had antitumor potential, and had lower toxicity in normal cells [26]. The administration of 100 mg of plant extract orally every day for 14 days raised granzyme expression in colorectal cancer patients, indicating its potential anticancer properties [27].

Euphorbia tirucalli

A variety of analytical techniques were used to determine total phenolic compounds (TPC), flavonoid, and proanthocyanidin levels in aqueous and methanol extracts of *Euphorbia tirucalli*. The extracts were discovered to limit the multiplication of pancreatic cancer cells, implying that they could be developed further into therapeutic treatments. The methanol extract inhibited the MiaPaCa-2 pancreatic cancer cell line's proliferation more effectively [28].

Micrandra elata

Micrandra elata, a Peruvian plant, was studied for its anti-cancer properties. In mice, the chloroform soluble portion of methanol extract of roots inhibited P-388 lymphocytic leukaemia. The presence of Isofraxidin, a cytotoxic coumarin has also been discovered in *Micrandra elata* twig extract, which is the main anti-cancer phytochemical in it [29].

Conclusion:

Thus it can now be easily evaluated that the plants in the family Euphorbiaceae could be employed as possible medicinal medications for the treatment of diabetes and cancer-causing cells. However, more biochemical and pharmacological research is being conducted to determine the mechanism of Euphorbiaceae plants antihyperglycemic and anticancer effects. However, a long-term study is required because plant compounds are slower to act than synthetic medications and may potentially demonstrate a plateau effect at greater doses, which would be ineffective in disease treatment.

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12/17/2021