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Euphorbia Tirucalli Traditional use: An overview

Sandeep K. Dixit, Punita Kumari, Shivam Dixit, Rajmani Prajapati, S. K Raza and L. K. Thakur*

*Institute of Pesticide Formulation Technology,(Ministry of Chemicals and Fertilizers)
Sector-20, Udyog Vihar, Gurgaon-122016, Haryana, **INDIA**

Email: thakurlk1964@rediffmail.com

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ABSTRACT

Plant and animal products are known as the major source of drugs since times immemorial. They are ranked as the indispensable components of our life. There are numerous plants and plant based medicines that are being frequently used for the treatment of a large number of diseases. Besides, having enormous properties that are useful in terms of our daily life, the Biological/Pharmacological use of any plant enhances its importance. E. tirucalli is found in southern part of India. It is a small tree with erect branches. It is commonly known as shatala (Ayurveda) and Thirugakalli (sidddha). In the present article, efforts have been made to summarize the Pharmacological potential and phytochemical constituents of Euphorbia tirucalli: an important medicinal plant.

Keywords: *Euphorbia Tirucalli*, Pharmacological Potential, Phytochemical constituents.

INTRODUCTION

India is known for its rich diversity of flora across the whole world. Owing to this fact, the use of plants as a source of medicines has been the inherent part of life in India since ancient times. More than 3000 plants have been officially documented in India that holds great medicinal potential. The World health Organisation (WHO) estimates that about 80% of the population living in the developing countries rely almost exclusively on traditional medicine for their primary healthcare needs [1].

Euphorbia tirucalli is a cactus-like plant belonging to the Euphorbiaceae family. The family is a major group belonging to the angiosperms comprising of succulents and herbaceous plants. The plant can be easily recognized due to its erect, slender and brush-like branch masses. The tree is evergreen and rarely fed on by herbivores.

Scientific Classification: According to the binomial nomenclature *E. tirucalli* has been classified as follows:

Kingdom	:	Plantae
Division	:	Magnoliophyta.
Class	:	Magnoliopsida
Order	:	Malpighiales

Family	:	Euphorbiaceae
Genus	:	Euphorbia

Monograph[2]:

Africa	:	Kraalmelkbos
Bengali	:	Lanka sij, Siju, Latadaona
China	:	Lu Yu Shu
English	:	Pencil tree, naked lady, milk bush, Petroleum plant
French	:	Tirucalli, Gardemaison
Guajarati	:	Kharasani, Thor dandalio
Hindi	:	Konpal, Sehund, Konpalsehnd, Barki-Sehund
Javanese	:	Kayu urip
Kannada	:	Bonta kalli, Mondugalli
Malay	:	Tulang, Kayupatah
Marathi	:	Sher-Kandvel, Kada nivalli, Vajraduhu
Oriya	:	Vajradruma
Sanskrit	:	Trikantaka
Spanish	:	Alfabeto chino, Antena, Consuelda
Telugu	:	Chemudu
Thai	:	Khiacheen, Khtalhian
Ugandan	:	Kakoni (luganda), Oruyenje (runyankole)
Vietnamese	:	Sanh(oo) xanh, X(uw) (ow)ng c(as).

Habitat and Distribution across the globe: *Euphorbia tirucalli* occurs in varying habitats ranging from grassy hills, rocky outcrops and ridges along river courses and open savannah. The associated geology varies from granite, sandstone and rhyolite. The species is associated with dense thickets and the plant itself may form hedge-like barriers in the veldt. It was introduced from Africa as a garden plant and now naturalized in tropical areas and rainforests in Amazon, Madagascar and South Africa. Outside Africa, it also occurs in India, Indonesia, China and the Philippine Islands. In India, it is mainly found growing in Maharashtra, Karnataka, Kerala and Tamil Nadu where it occurs as a tropical weed and found along the roadsides and wastelands. [3,4], Phillipine medicinal plants; URL: www.stuardxchange.com/Bali-bali.html

Morphology: *Euphorbia* is a branched, succulent plant, usually 3-5 m tall but may reach 10 m on occasion.

Bark: The bark of very old specimens is grey and rough with longitudinal dents and ridges that breaks up into very small fragments. Small protuberances such as a bulge, knob, or swelling are prominently noticeable on the bark while black, rough and crosswise bands are seen occasionally.

Branches*:* The branches are cylindrical, smooth and green with a diameter of 5-8 mm and form brush-like masses that are the best known feature of this species.

Leaves*:* The leaves are small, slender, alternate up to 12 x 1.5 mm and are rarely seen, as they shed quiet early and thus the function of leaves are taken over by the green branches. They are mainly simple but when compound, are always palmate, never pinnate. Stipules may be reduced to hairs, glands, or spines, or may be sometimes absent in the succulent species.

Flowers*:* The flowers are yellow, subtle and grown either in clusters at the apex of the short branches or in the angles of branches. They are radially symmetrical, monoecious or dioeceous, unisexual, with male and female flowers usually occurring on the same plant. They appear during September to December.

Fruits*:* They are tripartite capsules (divided into three parts), about 12mm in diameter, longitudinally slightly lobed, short-stalked (8mm), pale green, with a pink tinge and conspicuously pubescent (clothed with soft hairs) and dehisce while still on the tree. The fruits appear from November to December.

Seeds: The seeds are oval, about 4 x 3 mm, smooth and dark brown with a white line around the small white caruncle (fleshy wart near the hilum of the seed).
Latex*:* This spineless species contains large quantities of latex which is freely exuded by the twigs and branchlets at the slightest injury. It is characteristic of the subfamily Euphorbioideae and is poisonous. This poisonous nature of latex well explains the low herbivore attack, pesticidal and medicinal properties of the plant.
Propagation and Parts used: *E. tirucalli* can be propagated by seeds but usually stem or root cuttings are used. It establishes quickly and almost in any type of soil. Cuttings should be at least 10 cm. Long and should be left dry at least 24 hours before plantings. For ornamental purposes, cuttings of 35 to 40 cm long are usually taken and for hedges, cuttings of upto 1 mt long are used. *E. tirucalli* can also be propagated via micropropagation. The different parts of the plant that are used are: roots, stem and latex.

Folklore: The tradition of using plants as a source of herbal medicines to cure and prevent diseases is well-known of this country. All these are based on the factual knowledge of observations and the experiences from the past. Due to presence of a large number of chemical substances found in the different parts of *E.tirucalli*, it has been exploited in different parts of the world for its therapeutic value. Table 1 listed below describes the different parts of *E. tirucalli* that has been used in the traditional system of medicines. (Philippine medicinal plants (www.stuartxchange.com/Bali-bali.html)

Table 1. Traditional use of different parts of *E.tirucalli*

S. No.	Plant Parts	Traditional Use
1	Root	Root Scrapping mixed with coconut oil used in stomach ache
		Decoction of roots used for curing colic and gastralgia
		Infusion of roots used for bone pains
		Poultice of root used for curing haemorrhoids & ulcerations of nose
		Used for treatment of schistosomiasis and sexually transmitted disease
2	Stem	Poultices of stem used for healing bone fractures
		Stems are pounded and used for swellings & haemorrhoids (Malaysia)
		Poultice of pounded stems are used to extract thorns (Dutch Indies)
3	Latex	Used for treatment of asthma, cough, earache, neuralgia, rheumatism, toothache & warts (India)
		Used to cure abscesses, asthma, cancer, stomach aches and tooth aches (Peru)
		Used as a fish poison (Philippines)
		Latex boiled in milk used as an antidote against poisoning & snake bites
		Used to cure sexual impotency, warts and epilepsy
4	Milky Juice	In small doses used as purgative & as emetic in large doses
		Juice mixed with butter is said to cure infections of the spleen & acts as a purgative in colic and bowel complaints
		Fresh acrid juice used as vesicatory
		Used to raise blisters especially in syphilitic nodes
		Used to cure insect bites, ear aches, whooping cough, asthma & itching problems

Phytochemical Constituents: The pharmacological potential of any plant is attributed to its active ingredients. The foundation of Ayurveda lies upon these active ingredients with alkaloids being the chief

component. These active ingredients have been identified, studied, purified and in some cases have also been synthesized which reflects a cost-effective treatment. A large number of biochemical compounds have been isolated and identified from the *E. tirucalli.* These major constituents are summarized in Table 2.

Table 2: Phytochemical constituents of *Euphorbia tirucalli*.

S.No.	Plant Parts	Phytochemicals Reported	References
1	Latex	Triterpenes (Cycloeuphordenol, Cyclotirucanenol, cycloeuphornol)	[5,6,7]
		Diterpene esters of phorbol, ingenol & 12-deoxyphorbol esters.	[5]
		Serine proteases	[8]
		Steroid	[9]
	A. Fresh Latex	Terpenic alcohol, isoeuphorol, taraxasterol, tirucallol.	[10,11]
		12, 13-acetates, acylates of phorbol, 3-acylates of ingenol, Isoeuphorol.	[12]
	B. Dried Latex	*Euphorone,*	[10,12]
2	Stem or Whole plant	Hentriacontene, Hentriacontanol, β-sitosterol, Taraxerin, 3,3'-di-O methylellagic acid, Ellagic acid, Citric acid, Malonic and some Bernstein (succinic) acids.	[13]
		4-deoxy-phorbol ester, Caoutchouc, Casuariin, Corilagin, Cyclotirucanenol, Euphorbins, euphol, gallic acids and glucosides	[14,15]
		Cycloeuphordenol	[15,16]
		Euphorcinol	[17].
		Ingol ester (3,7,12-tri-O-acecy1-8-isovalaryl-ingol)	[14].
		Tirucallins A, B and euphorbin F, monomeric and dimeric ellagitannins.	[18]
		Eupha-7, 9(11), 24-trien-3-ol.	[19]
		4-deoxyphorbol	[20]
		Unsaturated irritant diterpene esters	[21]
		β-amyrin synthase	[22]
		Euphorgenol	[23].
		α-euforbol and taraxasterol, tirucallol	[24,25].

Pharmacological Potential: Several studies have been conducted using *E. tirucalli* extracts including its latex and numerous activities have been demonstrated. Latex obtained from the plant has highly irritant

property and showed both tumor promoting and tumor suppressing activity. However, the possible mechanism of these effects is still illusive. The various important properties exhibited by this plant have been summarized in Table 3.

Table 3: Pharmacological Profile of *E.tirucalli*

Activity	References
Anti-inflammatory	[26]
Molluscicide	[27,28].
Antiviral, Larvicidal, Cytotoxic activity against tumorous cell.	[19]
Antiarthritic	[53]
Antibacterial activity	[29]
Pesticidal activity	[30]
Antiherpetic activity	[31]
Anti-mutagenic	[32]
Co-carcinogenic	[33]
Tumor promoting activity	[54]
Tumor suppressing activity	[34]
Anti-carcinogenic	[35,36]
Antiproliferative	[37]
Anti-termite	[38]
Anti-fungal	[39]
Nematicidal	[40]

Studies on *E.tirucalli*: So far large number of studies has been carried out using *E. tirucalli* extracts and the results have been tremendously remarkable and could possibly contribute to the development of new drugs. Table 4. Lists the various studies that have been reported so far which is of considerable interest to the researchers.

Table 4. Well documented studies on *E.tirucalli*

S. No.	Studies	Conclusions	References
1	Healing of wounds in mice	The hydroalcoholic extracts of E. tirucalli demonstrate better outcomes in healing process.	[41]
2	Role of Euphol, on breast cancer cells.	Euphol is an active agent that exerts anticancer activity by arresting cell cycle of cancer cells.	[42]
3	Anti-inflammatory effect of Euphol on TPA-induced skin inflammation.	Euphol represents a promising agent for the management of skin diseases with an inflammatory component.	[43]

4	Role of Euphol on gastric cancer cell growth.	Euphol selectively induced gastric cancer cells apoptosis by modulation of ERK signaling, and could thus be of value for cancer therapy	[37]
5	*E. tirucalli* as a possible co-factor in endemic Burkitt Lymphoma.	*E. tirucalli* is able to reactivate EBV and determine chromosomal alterations, which leads to c-MYC altered expression.	[44]
6	Role of Euphol in treatment of colitis in mice.	Euphol is effective in reducing the severity of colitis.	[45]
7	Activity of Euphorbiaceae extracts in human lymphocytes.	Presence of novel candidates within Euphorbia plants that induce proliferation and apoptosis in human lymphocytes.	[46].
8	Euphorbiaceae plant extracts against *Aedes aegypti* and *Culex quinquefasciatus.*	Use of *E. tirucalli* extracts is an ecofriendly approach for the control of the dengue vector, and the lymphatic filariasis vector.	[47]
9	Role of aqueous extracts of *E. tirucalli* on freshwater fish.	Aqueous extracts of *E. tirucalli* adversely affect respiratory pathway of fish and cause energy crisis during stress by suppressing ATP production.	[48].
10	Role of *E. tirucalli* latex on lytic cycle of Epstein-Barr virus.	Latex of *E. tirucalli* could directly activate the EBV lytic cycle	[49].
11	Biopolymeric fraction of *E.titucalli* in arthritis.	Biopolymeric fraction showed dose-dependent anti-arthritic activity and in vivo immunomodulatory capacity in inhibiting arthritis.	[53]
12	Study on inganen diterpenes extracted from *E. tirucalli* latex.	Inganen has an inhibitory effect on tubulin polymerization. Neurons exposed to Inganen initiate a cellular process than can lead to cell death - Inganen-induced apoptosis	[50]
13	Biogas production from *E.tirucalli*.	*E. tirucalli* is a good feedstock for biogas production under laboratory conditions, with biogas production ranging from 218 to 293 liters/kg dry matter.	[5].

Salient Features of *E.tirucalli:* A Quick View

1. It can grow well in dry regions or lands and can survive even in hardier conditions probably due to combining of C3 and CAM photosynthetic pathways [51].
2. It can produce about 10-50 barrels of oil per acre by cutting near the ground[30].
3. Since, the latex contains rubber, whole plant harvesting seems most advisable from energy point of view with rubber, petroleum & alcohol as energy products and resins which may find use in linoleum, skin oil and leather industries [24,25].

4. Due to the poisonous nature of the Latex, there is low herbivore attack and also accounts for pesticidal and medicinal properties. However, it is attacked by pests like: *Meloidogyne incognita* Cuscuta spp. [51] and Botrytis spp. [52].
5. *E.tirucalli* has recently made popular headlines as a potential cancer cure[10]
6. It is also called as petroleum plant as it produces a hydrocarbon substance very much like gasoline[30].

Toxicity Concern

Toxicity, immune suppression, tumor-promoting and cancer concerns: Studies have demonstrated that the latex of the plant is toxic. Phorbol ester, a chemical constituent derived from the plants are highly irritating and has been documented as tumor promoters. There are literatures which have shown that phorbol enhances Epstein-Barr virus (EBV) infection, causes DNA damage and suppression of the immune system. Although touted folklorically for treating cancers, studies on its esters shows tumor-promoting activity. The latex has been documented to promote tumor growth and/or trigger certain cancers. Some studies consider it an environmental risk factor for Burkitt's lymphoma.
Contact Irritant / Keratoconjunctivitis: If the latex comes in contact with the skin, it causes irritation and burning sensation. It's ingestion has been reported to cause burning and irritation of the mouth, nausea, vomiting or diarrhoea. Several deaths have been attributed to the use of *E. tirucalli* for medicinal purposes. Reports have revealed occurrence of keratoconjunctivitis (chemical eye injury) as a result of exposure to its latex. Studies on rats showed rapid severe inflammation, oxytocin response, pro-convulsive and anti-convulsive effects.

CONCLUSIONS

Use of plants as a source of herbal medicines can be traced to remote past. Throughout human civilization, the plant world has provided a rich source of medicinal and recreational drugs. Although, synthetic drugs are effective in curing large number of diseases they have often been cited to produce a number of side effects including serious health issues.

Plant-based medicines are thus preferred over the synthetic ones as humans have co-evolved with plants over the past several millions of years and also because they are safer. The present review focuses on the prodigious history of *E.tirucalli*, an important medicinal plant and ascertains its medicinal value and briefly describes its classification, habitat, distribution, propagation, traditional use, phytochemical constituents, pharmacological potential & toxicity concern and is intended for serve as a reference tool to the researchers.

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