

**A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF  
*EUPHORBIA TIRUCALLI***

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**Summary**

*Euphorbia tirucalli* is an ornamental plant commonly known as Aveloz. The plant belongs to Euphorbiaceae family. The species of Euphorbiaceae is extensively used as a folk remedy by local population of many countries to cure numerous diseases such as cancer, diabetes, diarrhoea, heart diseases, hemorrhages, hepatitis, jaundice, malaria, ophthalmic diseases, rheumatism and scabies etc., *E. tirucalli* is studied extensively by advanced scientific techniques and various bioactive constituents have been isolated from different parts of the plant and analyzed pharmacologically. The plant is reported for hepatoprotective, antimicrobial, antioxidant, insecticidal, larvicidal, molluscicide and antiarthritic activity. The medicinal properties of this plant indicate it as a valuable source of medicinal compound. This study is overall information concerning the ethnobotany, phytochemistry, pharmacology and biological activities of *E. tirucalli*.

**Keywords:** *Euphorbia tirucalli*; antimicrobial activity; antioxidant activity; ethno botany; phytochemistry

**Introduction**

*E. tirucalli* is widely grown as an ornamental plant in India and is popularly known as Aveloz.<sup>1</sup> This plant was introduced from Africa to tropical countries as a garden plant.<sup>2</sup> It is found in Brazil, and northeast region of Amazon and in some coastal areas of Iran. The plant is a large unarmed shrub or a small tree growing up to 5 m tall with erect branches, bark is rough and cracked greenish brown, exuding a milky sap when cut, branch lets slender, smooth, cylindrical, polished, whorled and modified into phylloclade.<sup>3</sup>

*E. tirucalli* is widely used in traditional medicinal system. Most recently *E. tirucalli* is reported for various medicinal properties (Figure1). Stem bark and leaves are reported to possess antibacterial activity.<sup>2</sup> Aerial parts of *E. tirucalli* are reported to possess antioxidant activity.<sup>4</sup> Organic solvent exhausted material of *E. tirucalli* is reported to have antiarthritic activity.<sup>5</sup> Latex is reported to possess proteolytic activity<sup>6</sup>, anticancer activity<sup>7</sup>, molluscidal activity<sup>8</sup> and larvicidal activity.<sup>9</sup> Stem of *E. tirucalli* is reported to possess insecticidal activity.<sup>10</sup> The present review is focused on overall outline of the medicinal properties and biomolecules of *E. tirucalli* and its future prospects for the further scientific investigation for the development of effective therapeutic compounds.

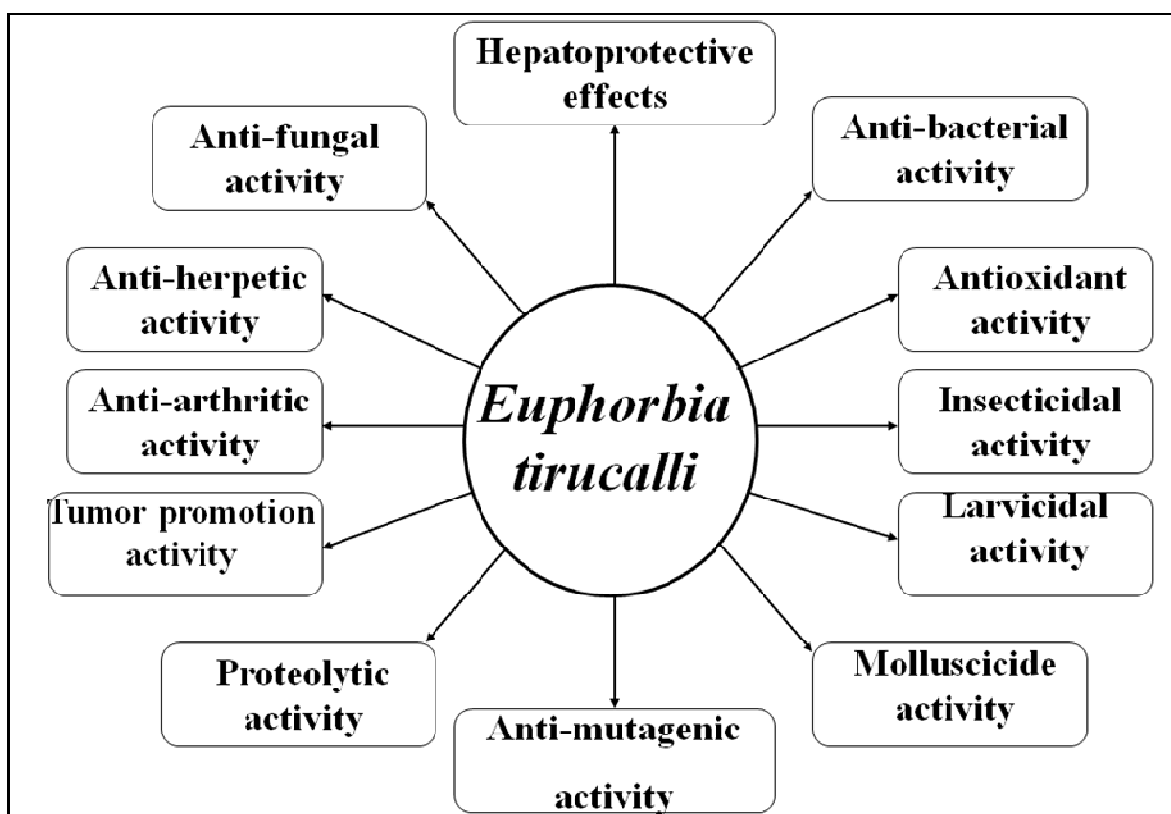


Figure1: Medicinal properties of *Euphorbia tirucalli* Linn



**Figure 2: *Euphorbia tirucalli* Linn**

### **Taxonomy**

The plant belongs to the Kingdom: Plantae, Division: Magnoliophyta, Class: Magnoliopsida, Order: Malpighiales, Family: Euphorbiaceae, Subfamily: Euphorbioideae, Genus: Euphorbia L., Species: *E. tirucalli* L.

### **Traditional use of *E. tirucalli***

The latex of *E. tirucalli* is traditionally used in treating asthma, rheumatism, earache, cough and toothache.<sup>11</sup> The latex is used as a folk remedy against syphilis. It is used as a laxative agent to control intestinal parasites and also to treat verrucae, epithelioma, sarcoma and skin tumours in northeast region of Brazil.

The stem of *E. tirucalli* is used to treat whooping cough, asthma, blood complaints and in infections of spleen. Stem is carminative, purgative, stomachic, dyspepsia, gonorrhoea, leprosy, neuralgia and syphilis. The Bark of *E. tirucalli* is used traditionally in healing the infections of spleen, colic, blood complaints, whooping cough and asthma. Roots of *E. tirucalli* are used for treating colic pains.<sup>12</sup>

In certain parts of East Africa, the leaf of *E. tirucalli* is boiled and the juice is used in management of sterility of women traditionally.<sup>13</sup> *E. tirucalli* is also used to cure snakebites, warts, syphilis, sexual impotence and in skin parasites extraction in Africa. It is popularly used in healing broken bones, hemorrhoids, pains, ulcerations, swellings in Asia. In addition to this, it is used to treat scorpion bites, asthma, cancer, spasms in Brazil.<sup>14, 15</sup> The plant was reported to have abortifacient and emmenagogic effects in Ayurvedic system of medicine.<sup>16</sup>

### **Phytochemistry**

*E. tirucalli* is reported to possess flavonoids, diterpenes, tannins, steroids and alkaloids as major phytochemical compounds<sup>17</sup>. The plant is also reported to possess terpenes, alcohol eufol, alfa-euforbol<sup>18</sup>, taraxasterol, *E. tirucallol*, cycloeuphornol, n-hexacosanol<sup>19</sup>, terpenic alcohol and

triglycane. Whole plant has afforded to contain 7.4% citric acid with some malonic and succinic acids. Terpenoids and sterols in plants are important sources of vitamins, steroid compounds, insecticides and anticancer drugs industrially.<sup>20,21</sup>

### Latex

The major components of *E. tirucalli* latex are triterpenes.<sup>22,23</sup> Latex contains diterpene esters of the phorbol, ingenol and 12-deoxyphorbol esters, reported to be highly active carcinogenic and tumour promoting agents. The fresh latex is reported to contain terpenic alcohol, isoeuphorol, taraxasterol and tirucalol.<sup>24</sup> Dried latex contains Ketone euphorone. Resin is the principle constituent of dried latex of *E. tirucalli*.

### Stem

The stem is reported to possess hentriacontene, hentriacontanol, anti tumor steroid 4-deoxyphorbol ester, beta-sitosterol, casuarin, corilagin, cycloeupordenol, cyclotirucanenol, ellagic acids, euphorbins, euphol, euphorone, ellagic acids, euphorbins, euphol, euphorone, euphorcinol, gallic acids and glucosides.<sup>25</sup>

### Medicinal properties of *E. tirucalli*

#### Hepatoprotective effects

Aqueous extract of aerial parts of *E. tirucalli* was reported for hepatoprotective activity in adult Wistar rats and Swiss albino mice against carbon tetrachloride induced liver damage. The extract resulted in decrease of GSH depletion and lipid peroxidation and showed effective protection of liver.<sup>4</sup>

#### Antimicrobial activity

The alcoholic extracts of stem bark and leaves of *E. tirucalli* were reported to possess antimicrobial activity against clinical and lab isolates of *Escherichia coli*, *Proteus vulgaris*, *Salmonella enteritidis*, *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Candida albicans*, *C. tropicalis*, *Aspergillus niger*, *A. fumigatus*, *A. flavus* and *Fusarium oxysporum*.<sup>2</sup>

Antibacterial activity of methanol extract and its aqueous extract of *E. tirucalli* was reported. Antibacterial activities were performed by agar disc and agar well diffusion methods against *Staphylococcus epidermidis*, *Bacillus subtilis*, *Pseudomonas pseudoalcaligenes*, *P. vulgaris* and *P. typhimurium*. Methanol extract showed activity against *P. pseudoalcaligenes*.<sup>26</sup>

Acetone, hexane, methanol, chloroform and petroleum ether extracts of the stems of *E. tirucalli* were reported to possess antibacterial activity against seven bacterial species included *Bacillus megaterium*, *B. subtilis*, *Escherichia coli*, *Enterobacter faecalis*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and antifungal activity against *Aspergillus niger*, *A. fumigatus* and *Candida albicans*.<sup>3</sup>

**Antioxidant activity**

Aerial parts of *E. tirucalli* were reported to carry antioxidant activity. Aqueous extract of aerial parts of *E. tirucalli*, shows reducing power activity, superoxide anion scavenging activity and hydroxyl radical scavenging activity. All the doses of the extract exhibited greater absorbance than control. At 100 µg concentration extract showed 54% superoxide anion scavenging activity. 100 µg/ml concentration of aqueous extract exhibited maximum hydroxyl radical scavenging activity.<sup>4</sup>

**Insecticidal activity**

Petroleum ether and ethyl alcohol extracts of *E. tirucalli* were evaluated against larvae of diamond back moth (*Plutella xylostella*) using standard leaf dip method. Stem extracts of *E. tirucalli* at 2.5 percent concentration showed a maximum of 16.5% mortality at 96 h after treatment.<sup>10</sup>

**Larvicidal activity**

The fresh latex of *E. tirucalli* was tested for larvicidal activity against *Anopheles funestus* and *A. gambiae* in a neglected fish pond in different dilutions. All the dilutions showed activity against the larvae, but highest dilution (1:250) is preferable in order to minimize the excess usage and over dosage problems of latex.<sup>9</sup>

**Molluscicide activity**

*E. tirucalli* latex is reported to possess molluscicide activity against *Biomphalaria glabrata* (snail) which is a mollusc vector of schistosomiasis. In this study, latex was collected from this plant at large amount of sunlight receiving sites. 10% dilution was prepared with water and was tested against *B. glabrata*, eggs of the snail and fishes in comparison with Bayluscide and copper sulphate. The extract showed molluscicidal activity with LD<sub>50</sub> at 28 ppm and LD<sub>90</sub> at 85 ppm.<sup>8</sup>

**Antiarthritic activity**

The biopolymeric fraction of *E. tirucalli* (BET) was reported for antiarthritic activity against *Mycobacterium tuberculosis* induced adjuvant arthritis test in rats. Wistar rats were injected subplantarly with 0.05 ml freshly prepared suspension of heat killed *M. tuberculosis* in liquid paraffin to induce adjuvant arthritis.<sup>27</sup> BET showed significant inhibition of edema in the injected paw with a maximum effect at dose levels of 100 and 200 mg/kg orally. BET administered groups, however, did not show significant swelling in the uninjected paw (secondary response) of the experimental rats when compared to the vehicle control group.<sup>28</sup>

### Conclusion

In recent years, medicinal plants have been significantly studied for their phytochemical properties which brings known and unknown medicinal virtues. Phytochemical screening of *E. tirucalli* reveals it, as a valuable medicinal plant with numerous medicinal properties. Many new drugs can be developed from *E. tirucalli* to control numerous diseases with no side effects as it is from natural source. A typical research and developmental work should be carried out for the conservation of *E. tirucalli* for their better therapeutic and commercial utilization.

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### References

1. Caius JF, The medicinal and poisonous Plants of India, Scientific Publishers, Jodhpur, India.
2. Bhuvaneshwar U, Singh KP and Kumar A, Ethno-medicinal, Phytochemical and Antimicrobial studies of *Euphorbia tirucalli* L. Journal of Phytology 2010; 2:65-77.
3. Prasad S, Swapna NL, Prasad M, Efficacy of *Euphorbia tirucalli* (L) towards microbicidal activity against human pathogens. International Journal of Pharma and Bio Sciences 2011;2: 12-18.
4. Jyothi TM, Shankariah MM, Prabhu K, Lakshminarasu S, Srinivasa GM and Siddamsetty R, Hepatoprotective and Antioxidant activity of *Euphorbia tirucalli*. IJPT 2008; 7:25-30.
5. Sarang B, Kaul A, Khana B, Gupta VK, Satti NK, Suri KA, Qazi GN, Anti-arthritis activity of a biopolymeric fraction from *Euphorbia tirucalli*. Journal of Ethnopharmacology 2007; 110:92-98.
6. Cleverton de Freitas DT, Diego de Souza P, Eliane S, Araujo, Mariana G, Cavalheiro, Luciana S, Oliveira and Marcio V, Ramos, Anti-oxidative and proteolytic activities and profile of laticifer cells of *Cryptostegia grandiflora*, *Plumeria rubra* and *Euphorbia tirucalli*. Brazilian society of plant physiology 2010; 22(1):11-22.
7. Ali K, Gholam HR, Mahmoud G, Marzieh R, Akira T, Yutaka N, Hossain N, Effect of ingenan anticancer properties on microtubule organization. Pak J Pharm 2010; 23:273-278.
8. Pedro J, Januario BCN, Virginia TS, Molluscicide activity of the avelos plant (*Euphorbia tirucalli*, L) on *Biomphalaria glabrata*. The Mollusc vector of Schistosomiasis, Mem. Inst. Oswaldo cruz, Rio de Janeiro 1985; 80(4):423-427.
9. Mwine J, Damme PV, Jumba F, Evaluation of larvicidal properties of the latex of *Euphorbia tirucalli* L. (Euphorbiaceae) against larvae of *Anopheles* mosquitoes. Journal of Medicinal Plants Research 2010; 4(19):1954-1959.
10. Uma MS, Prasanna PM, Efficacy of some Euphorbiaceae plant extracts against cabbage diamondback moth, *Plutella xylostella* L. Karnataka J. Agric. Sci 2009; 22(3):688-689.
11. Wealth of India, the dictionary of Indian raw materials and industrial products. Council of Scientific and Industrial Research, New Delhi, India.

12. Rao SR and Hemadri L, Medicinal plants in Andhra Pradesh. Ministry of Human Resource Development, New Delhi.
13. Kokwaro, JO, Medicinal plants of East Africa. Nairobi: E.A. Literature Bureau, Kenya.
14. Cataluna P, Rates SMK, The traditional use of the latex from *Euphorbia tirucalli* L (Euphorbiaceae) in the treatment of cancer in South Brazil. ISHS Acta Hort 1997; 50:1-14.
15. Van DPLJ, In vitro antifungal activity of methanol extracts of some Indian medicinal plants against pathogenic yeast and moulds. Kluwer Academic Publishers, India.
16. Chopra RN, Chopra IC, Handa KL, Kapur LD, Indigenous drugs in India. Kolkata: UN, Dhar and Sons, India.
17. Fauconneau B, Waaffo-Tequo F, Hugnet F, Barries I, Decandit A, Merillon JM, Comparative study of radical scavenger and antioxidant properties of phenolic compounds from *Vitis vinifera* cell culture using in vitro tests. Life Sciences 1997; 16:2103-2110.
18. Macdonald AD, Warren FL and Williams JM, The Euphorbia resins, Part I. Euphol. Pakistan Journal of Scientific and Industrial Research 1949; 155-157.
19. Rastogi RP and Mehrotra BN, Compendium of Indian Medicinal Plants. CDRI-NISC, New Delhi.
20. Itokowa H, Ichihara Y, Watanabe K, Takeya K, An antitumor principle from *Euphorbialathyris*. Planta Med 1989; 55(3):271-272.
21. Wu T, Lin Y, Haruna M, Pan D, Shingu T, Chen Y, Hsu H, Nakano T, Lee K, Antitumor agents, Kansuiphorins A and B, two novel antileukemic diterpene esters from *Euphorbia kansui*. J Nat Prod 1991; 54:823-829.
22. Biesboer DD, Mahlberg PG, The effect of medium modification and selected precursors on sterol production by short-term callus cultures of *Euphorbia tirucalli*. J Nat Prod 1979; 42:648-657.
23. Yamamoto Y, Mizuguchi R, Yamada Y, Chemical constituents of cultured cells of *Euphorbia tirucalli* and *E. mailli*. J Plant Growth Regul 2011; 30:114-116.
24. Cataluna P, Taxa SMK, The traditional use of the latex from *Euphorbia tirucalli* Linnaeus (Euphorbiaceae) in the treatment of cancer in South Brazil. Acta Horticulture 1999; 501:289-296.
25. Khan AQ, Malik A, A new macrocyclic diterpene ester from the latex of *Euphorbia tirucalli*. J Nat Prod 1990; 53:728-731.
26. Parekh J, Jadeja S, Chanda S, Efficacy of aqueous and methanol extracts of some medicinal plants for potential antibacterial activity. Turkish Journal of Biology 2005; 29:203-210.
27. Newbould BB, Chemotherapy of arthritis induced in rats by mycobacterial adjuvant. British Journal of Pharmacology 1963; 21:127-136.
28. Arrigoni ME, Brahm E, Investigations in the influence of cyclophosphamide gold sodium thiomalate and d-pencillamine on nystatin oedema and adjuvant arthritis. Agents and Actions 1975; 5:264-267.