

# A Review on *Plumbago zeylanica* : A Compelling Herb

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**Abstract:** Herbal medicines are always in great demand, they are in use since the time of immortal. People all around the globe are dependent on herbal medicines because of their non-violent and non-toxic nature. All though there are so many alternative methods available but still people depend on herbal plants for their day to day life. Therapeutic plants are the solution to sinister and incapacitating effect of synthetic medicines. Herbal plants always prove them self as the primary product for synthetic drugs. *Plumbago zeylanica* is one such plant of great medicinal importance. *Plumbago zeylanica* is widely used plant for its therapeutic practises in traditional system of medicine. Especially the rural people in India are entirely reliant on herbal plants. With the revitalisation of herbal plants across the world, *Plumbago zeylanica* is broadly used for commercial preparation of medicines due to its biological activities. So the present study précises our existing information on *Plumbago zeylanica*, its major bioactive, traditional and medicinal uses of *Plumbago zeylanica*, as an advance to additional study on this valuable plant.

**Keywords:** *Plumbago zeylanica*, chitrak, therapeutic uses, chemical constituents, traditional values, medicinal plant.

## 1. Introduction

*Plumbago zeylanica* L, commonly known as chitrak or lead wort-white flowered is innate to South Asia. It is dispersed in tropical and subtropical countries of the world. Budding in deciduous woodland, savannahs, scrublands from sea level up to 2000 m altitude [1, 2]. In India it is sprinkled in central India to West Bengal, Maharashtra, and Uttar Pradesh to some parts of South India. The plant also enjoys regional names in different state **Gujarati:** Agni / vahini, **Kannada:**chitramula, **Malayalam:** chitrakmula/ bilichitramula, **Punjabi:** Veellakeduveli, **Bangali:** chitra, **Tamil:** chita, **Telugu:** kodiveli/ chitramoolam, **Hindi:** chitraka/chitramol, **Sanskrit:** chitra [3]. But commonly used name persisted to be chitraka [4, 5]. *Plumbago* is from Plumbaginaceae family comprises of 10 genera and 280 species. The genus *Plumbago* take account of 3 species that is *Plumbago indica* L. (*P. rosea* L.) *P. capensis* L., and *P. zeylanica* L., in all these 3 species *Plumbago zeylanica* is most cultivated because of its high therapeutic uses. It is an oldest herb that was used in Ayurveda for several disorders over thousands of years. It grows wild in India and also refined commercially

### 1.1 Morphology

There is no uniformity in literature that states *P. zeylanica* is herb or shrub. It is a perennial bushy shrub but in some of the works it is also defined as herb [6, 7] while some has given the class of shrub [8]. *P. zeylanica* plant accomplishes a height of about 0.5–2 m. Leaves are dark green in colour with the thickness of 1.5 inch and distance of leaf is roughly up to 3 inch The leaves are alternate, simple, ovate or ovate-lanceolate, elliptical or oblong and they consume hairy margin, The stipules are inattentive and petiole is thin with a tallness of approx. 0-5 mm. The inflorescence is of terminal raceme-type, flowers are white in colour with the stalk measurement of 4 to 12 inch, the diameter of the flower is ½ to ¾ inch, These are existent in bunches or clusters, They are bisexual, regular, pentamerous, pedicellate and pleasant fragrancd. The flowers come round the year and pollination process is completed with the help of insects. The mucilaginous glands supports the plant to trap the insects on it.

Calyx is dense and enclosed with stalked, some sticky glands are in existence in flower that makes the flower sticky, and Corolla is white in colour with slender and tubular. Stameus are 5 and free. Ovary is always superior, 5-gonous, one celled, ovule one, basal [9]. Light yellow roots were detected when the plant is garden-fresh, but bowed to reddish brown in colour when dried out, often initiate in the form of hard pieces, straight, long, unbranched or slightly branched root are always observed with or without secondary roots, the texture of the roots are unbroken and smooth, Roots are usually very strong and They have a distinctive odour with acrid and bitter taste.[6]

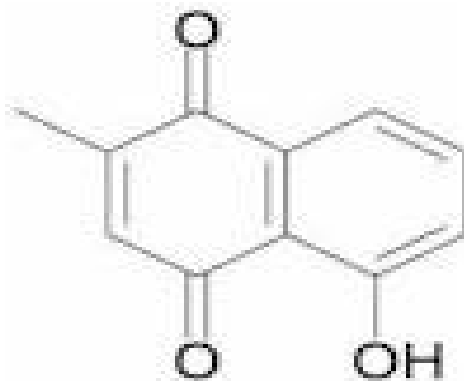


### 1.2 chemical composition

All herbal plants enclose some bioactive chemical compounds that illustrate innumerable imperative activities against diseases. So *P. zeylanica* also encompass imperative chemical compound that displays various actions, diverse parts of the plant enclose countless secondary metabolites like alkaloids, flavonoids, naphthaquinones, glycosides, steroids, saponins, triterpenoids, tannins, phenolic compounds, coumarins, carbohydrates, fixed oil and fats and proteins [1,10,11,12,13]. In all of these compounds the most imperative principle active compound is 'plumbagin'

#### Plumbagin

Plumbagin (5-hydroxy-2-methyl-1,4-naphthoquinone-  $C_{11}H_8O_3$ ) is present in roots of the plants [14]. It self-contained 1% present in entire plant. So plumbagin store in root majorly, plumbagin is a rationally stirring yellow pigment that patents in members of Plumbaginaceae and that too customarily in roots [14]. The stem has a lesser volume and leaves has no plumabgin. It is natural yellow pigment because of existence of naphthoquinone pigment [15], and is existing in the form of needles. Plumbagin is soluble in alcohol, acetone, chloroform, benzene, and acetic acid and is exceedingly toxic compound with corrosive possessions.



#### Structure of Plumbagin

Plumbagin has antibacterial activity in contradiction of numerous pathogenic bacteria [16]. The methanolic extract of plumbagin shows strong antibacterial activity against *Escherichia coli*, *Salmonella typhi* and *Staphylococcus aureus* [17], and inhibitory outcome in contradiction of *Klebsiella pneumoniae*, *Serratia marcescens* and moderate result in contradiction of *Bacillus subtilis*, and less lower effect contrary to *Proteus vulgaris* and *Pseudomonas aeruginosa*, and aqueous extract shows less antibacterial action as associated to organic extract. Plumbagin shown anticancer [18], antifungal [17], antimicrobial activity [19], antibiotic effects [19]. Five coumarins seselin [20], 5-methoxyseselin [21], suberosin [23], xanthyletin and xanthoxyletin were seized from the roots of *P. zeylanica* [22]. A very little concentration of plumbagin parades antimitotic movement analogous to colchicine.

### 1.3 Therapeutic uses

*P. zeylanica* is a widespread curative herb all over Africa and Asia. It has been cast-off as a cure for skin sicknesses, infections and intestinal worm's viz. leprosy, scabies, ringworm, hookworm, dermatitis, acne, sores and ulcers subsequently ancient times. The old systems of medicine in diverse parts of the landmasses have been employing all amounts of *P. zeylanica* for a diversity of treatments. The whole plant has medicinal effects but

the root of chitrak has ample therapeutic uses. Its Roots, bark and seed are used in variety of ailments. The fresh juice from roots is effective for internal piles, the roots of plant rise the digestion and promote appetite, and small doses excite central nervous system. Roots of the plant have abortifacient and vesicant effects. Paste prepared from roots of the plant is applied to the skin to treat abscesses, other skin diseases including ulcers and scabies also [24, 25]. Operative against chicken pox and acne. It is believed that paste from roots is effective against filarial leg. It is also used in contradiction of dysentery, diarrhoea, diuretic, and peptic ulcers and intestinal parasite [26]. If the paste from roots is taken with butter milk it relieves in piles and non-bleeding piles also. If the dried powder of roots is taken with honey relieves in hypercholostremi, the same is effective against anemia and helps the formation of blood cells. It is also reported that the dried powder of the roots is also effective against anemia. Many scientists believe that fever or malaria, rheumatism, intestinal parasites, anemia due to 'stagnant blood', internal and external trauma, toxic swelling and furunculosis scabies can be treated with this plant. [25, 27, 28, 29]. In Africa it is also used in influenza and black water fever. Bark of the plant is cast-off to stop bleeding, to treat wound, gonorrhoea, syphilis, tuberculosis, rheumatic pain, swellings, root and bark is also used to treat obesity. It is found active against sore throat, running nose. In some rural parts it is used in the form of local application for leukoderma, leprosy, psoriasis.

Various pharmacological findings have indicated that *P. zeylanica* extract has antiplasmodial [30], antimicrobial [31], antifungal [32], anti-inflammatory [33], antihyperglycemic [34], hypolipidaemic and antiatherosclerotic activities [35]. It is reported that it shows sufficient antidiarrheal [36], antiallergic [29], insecticidal, antidiabetic [34], hepatoprotective properties [37, 38]

## 2. Propagation

*P. zeylanica* is grown mostly by seeds, rooted shoots that is available at the bottom of the plant or by semi-ripe cuttings, preserved with growth regulators. Seeds sprout in 21–30 days and extended storing of seeds (over 3 months) consequences in a severe deterioration in germination rate. Propagating seeds in a nursery with consequent transplantation adducted to the ground at a density of 58 x 58cm is a favoured method of *P. zeylanica* plants proliferation. Though the plant can be developed in a range of soils, working from red soil to deep black soil; the plants favour fine profound sandy loam to clayey loam soil using great organic content. In natural habitats, the plants grow well in soggy soil with great organic content and moderately shaded positions with in-between warm temperatures.

Mostly traditional approaches of proliferation have confirmed to be problematic and insufficient to encounter the mounting requests of herbal plant on commercial scale.

The reason is largely recognized as deprived seed propagation and untimely demise of seedlings on plantation below standard circumstances. On the other hand, the method of *in vitro* proliferation is effectively exploited for mass multiplication of *P. zeylanica* by means of nodal explants, axillary buds, leaf or root explants and callus cultures

## 3. Chemical constituents of *Plumbago zeylanica*

*P. zeylanica* is greatly used for its chemical constituents that are present in various parts of the plants.

### 3.1 Leaf

Leaf of the plant contain mainly plumbagin that is the prime chemical component of the plant, along with **plumbagin** it contains

- Plumbagic acid
- Beta-sitosterol-4-hydroxy-benzaldehyde
- Trans-cinnamic acid
- 2,5-dimethyl-7-hydroxy chromone
- Isoshinanolone
- Indole-3-carboxaldehyde
- Vanillic acid

### 3.2 Roots

Roots contain mainly **Naphthoquinone** it includes

- 5,7-dihydroxy-8-methoxy-2-methyl-1,4-naphthoquinone (plumbagin)
- Biplumbagin
- Chloroplumbagin
- Maritinone
- Elliptinone
- 2-(1-hydroxy-1-methyl-ethyl)-9-methoxy-1,8-dioxacyclopenta (*b.g*)
- Naphthalene-4,10-dione, 9-hydroxy-2-isopropenyl-1,8-dioxacyclopenta (*b.g*)
- Isoshinanolone

- 2-isopropeny,1-9-methoxy-1,8-di-oxadicyclopenta( b,g)
- Lapachol

**Coumarins**

- 5-methoxy seselin
- Seselin
- Suberosin
- Xanthylctin
- Xanthoxylctin

**Plumbic Acid**

- 3'-o- $\beta$ -glucopyranosyl plumbagic acid
- 3'-o- $\beta$ -glucopyranosyl plumabagic acid methyl ester

**Enzymes**

- Invertase
- Protease

**Other Compounds**

Zeylinone, glucose, fructose, isozeylinone, droscrone, plumbaginol

**3.3 Flower**

- Plumbagin
- Glucose
- Zeylanone

**3.4 Stem**

- Plumbagin
- Dihydroflavinol plumbaginol
- Sitosterol
- Isozeylanone

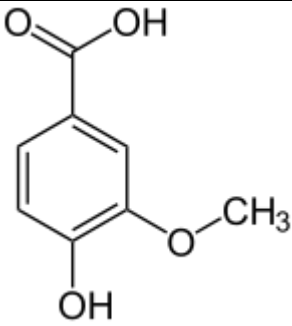
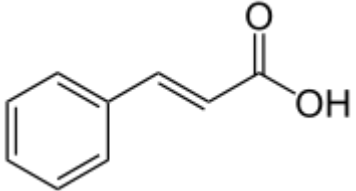
**3.5 Fruit**

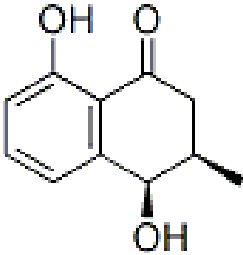
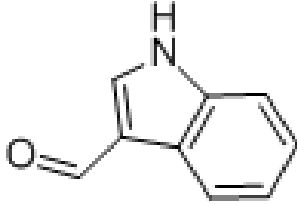
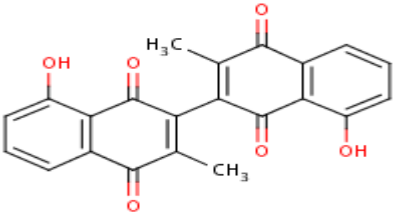
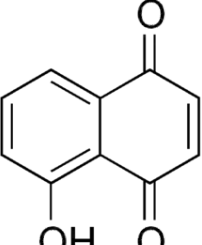
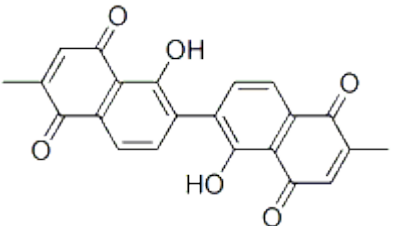
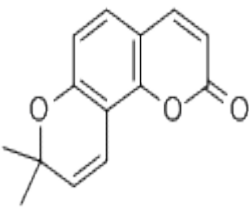
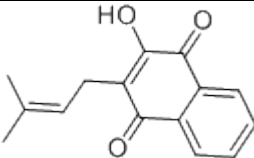
- Plumbagin
- Glucopyranoside
- Sitosterol

**3.6Seed**

- Plumbagin

**4. Chemical structures of some compounds present in *Plumbago zeylanica***

S.No	Name of Compound	Structure
1.	Vanillic acid	
2.	Cinnamic acid	

3.	Isoshinanolone	
4.	Indole-3-carboxaldehyde	
5.	3,3'-Biplumbagin	
6.	Napthoquinone	
7.	Elliptinone	
8.	Seselin	
9.	Lapachol	

## 5. Future Prospectus

Although *P. zeylanica* is an important plant in herbal manufacturing but still there is a need of strong determination to grow an alternative process for mass proliferation of the plant. Random sampling from the forest areas are on for *P. zeylanica*. This create a risk to the prevailing of *P. zeylanica* in nature. Fast development of *P. zeylanica* genotypes from micropropagation process and restricting the breeding procedure by means of marker-aided assortment definitely underwrites the crop development. Using *in vitro* practises at huge scale for development and successive ground plantations should be immeasurably valuable for the growing request *P. zeylanica*.

### Conclusion:

The review clearly shows the importance of *Plumbago zeylanica* as a useful medicinal plant. *Plumbago zeylanica* is used throughout the world for therapeutic purposes. The review encapsulates about the morphology of the plant along with its chemical composition, propagation, therapeutic use

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Table 1. Therapeutic uses of *Plumbago zeylanica* with references

S. No	Therapeutic uses	Reference No.
1	Antibacterial activity	39,27,19
2	Anticancer activity	40,41
3	Antiarthritic	42
4	Antimycotic	27,43
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