International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 2 Mar-Apr 2023, pp: 1264-1270 www.ijprajournal.com ISSN: 2249-7781

A Review: Plumbago Zeylanica

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Submitted: 05-04-2023 Accepted: 15-04-2023

ABSTRACT
Ayurveda is the most important and time-tested science of treating to different disease with natural things like animals, plant, and minerals. It remains one of the most ancient and yet living traditions practised generally in Sri Lanka, India, Canada, and other countries and has a sound philosophical and experiential basis. It is distributed as a wild plant throughout the sultry and subtropical countries of the world. Plumbago zeylanica is commonly known as a white chitraka, belongs to family plumbaginaceae. It is a perennial sub-scandent shrub, grows throughout India, especially in Bengal, Uttar Pradesh, South India and Canada Sri Lanka, in moist places. Traditionally it is used as a ulcer protective, stimulant, blood increasing expectorant, laxative, digestant, abortifacient and in the treatment of muscular pain rheumatic disease and some other disease.

Keywords: Plumbago zeylanica, Charak Samhita, Sushrut Samhita, Plumbaginaceae.

I. INTRODUCTION

Ayurveda is time-tested science of treating disease with natural things like plant, animals and minerals. It remains one of the most ancient and yet living traditions practised widely in India, Sri Lanka and other countries and has a sound philosophical and experiential basis. Atharvaveda (around 1200 BC), Charak Samhita and Sushrut Samhita (1000- 500 BC) are the main classics that give detailed descriptions of over 700 herbs. A scholarly description of the legacy of Charaka in contemporary idiom, best attempted with a commentary from modern medicine and science viewpoint, gives some glimpses of ancient wisdom. Indian healthcare consists of medical pluralism and ayurveda still remains dominant compared to modern medicine, particularly for treatment of a variety of chronic disease conditions. India has about 45,000 plant species; medicinal properties have been assigned to several thousands. About 2000 are found in the literature; indigenous systems commonly employ about 500–700.

The plant species Plumbago zeylanica is distributed as a weed throughout the tropical and subtropical countries of the world. The family Plumbagoginaceae consists of 10 genera and 280 species. The genus Plumbago includes 3 species, namely Plumbago indica L. (P. rosea L.) P. capensis L., and P. zeylanica L., which are distributed in several parts of India.Plumbaginales belongs to the superorder Malviflorae and comprises two families, Plumbaginaceae and Limoniaceae. Its representatives are chemically characterized by the presence of naphthoquinones, flavonoids, terpenoids and steroids, many of them being responsible for biodynamic activities. The Ayurvedic texts, later, have described the other properties of chitraka as anahaghna- deflatulent, gulmaghna- mitigates tumours, ajirna nasaka- that alleviates dyspepsia etc. [1]

It contain Plumbagin as the chief chemical constituent belonging to the class naphthoquinone, which is responsible for its corrosive effects. The red variety (Rakta Citraka) is considered to be more corrosive than white (Śveta Citraka) one . [2]Specific Śodhana (Purification) procedures have been adopted for the purification of Citraka (Plumbago zeylanica Linn. and Plumbago rosea Linn.) root and these methods are either mentioned in the classics of Āyurveda or practiced traditionally.[3]

BOTANICAL DESCRIPTION

Plumbago is a genus of 15-20 species of Angiosperms in the family Plumbaginaceae. The family Plumbaginaceae consists of 10 genera and 280 species. The genus Plumbago includes 3 species, namely Plumbago indica L. (P. rosea L.), P. capensis L., and P. zeylanica L., which are distributed in several parts of India. Among these species Plumbago zeylanica grows all mdistricts of plains in Tamilnadu, Andra Pradesh, Karnataka and Kerala, common, wild or in cultivation due to its more therapeutic uses.Plumbago zeylanica (PZ) commonly called as Doctorbush or Ceylon

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 2 Mar-Apr 2023, pp: 1264-1270 www.ijprajournal.com ISSN: 2249-7781

Leadwort is a semi climbing sub shrub that grows throughout Asia, Australia, Africa and Ceylon and widely used in ethnomedicine.11 It is used in indigenous system of medicine, and commonly known as "Chitthra mulam". It is branched evergreen shrub growing up to 2 meters. The leaves are dark-green, ovate 30cm long and 15 cm wide. The flowers are white in thick racemes, individuals around 1cm across, flowering throughout the year.[4-6]

Classification
Kingdom: Plantae
Order: Caryophyllales
Family: Plumbaginaceae
Genus: Plumbago
Species: Zeylanica

Regional names:
English: Lead wort, Ceylon lead wort
Hindi: Chira, Chitra
Gujarati: Chitrakmula
Kannada: Chitrakmula, Bilichitramala
Malayalam: Vellakeduveli
Punjabi: Chitra
Bengali: Chita
Tamil: Kodiveli, Chitramoolam
Telugu: Chitramulam

It is a perennial sub-scandent shrub, grows throughout India, especially in Bengal, Uttar Pradesh, South India and Sri Lanka, in moist places. It is also cultivated commercially. The flowering occurs from September to November. The red flowered variety of chitraka grows abundantly of Khasi hills. Found wild in Peninsular India and west Bengal, and cultivated in gardens throughout India.The plant grows 0.5-1.0 meters in height. [7]

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Morphology of different plant parts:
Flowers: Flowers are white in colour, 10-25 cm long, inodorous, inbracteate, axillary and terminal elongated spikes, and bisexual. Calyx densely covered with stalked, sticky glands. Corolla is white, very slender, and tubular and Stamens 5, free. Ovary superior, 5-gonous, one celled, ovule one basal.
Herb: A rambling sub-scandent perennial herb or under shrub with green branches.
Roots: 30 cm or more in length, 6 mm or more in diameter, stout, cylindrical, friable, blackish red in colour, light yellow coloured when fresh, reddish brown when dry, straight unbranched or slightly branched with or without secondary roots, with uniform and smooth texture. It has characteristic odour with acrid and bitter taste.[8]
Stems: somewhat woody, spreading, terate, striate, glabous. It attains a height of about 0.5–2 m (1.6–6.6 ft) Bark is thin and brown in colour.
Leaf: simple, alternate, 8 cm long and 3 cm broad, ovate or oblong, petiole narrow, amplexicaul at the base and often dilated into stipule like auricles.
Flowers: white in colour, 10-25 cm long, inodorous, inbracteate, axillary and terminal elongated spikes, and bisexual. Calyx densely covered with stalked, sticky glands. Corolla is white, very slender, and tubular and Stamens 5, free. Ovary superior, 5-gonous, one celled, ovule one basal.
Fruit: Oblong (7.5–8 mm long) five-furrowed capsule containing single seed. Each seed is oblong in structure, 5–6 mm long and reddish- brown to dark brown in colour.[9]

PHYTOCHEMISTRY
Stem: Stem contain plumbagin, zeylanone, isozeylanone, sitosterol, stigmasterol, campesterol, and dihydroflavinolplumbaginol.

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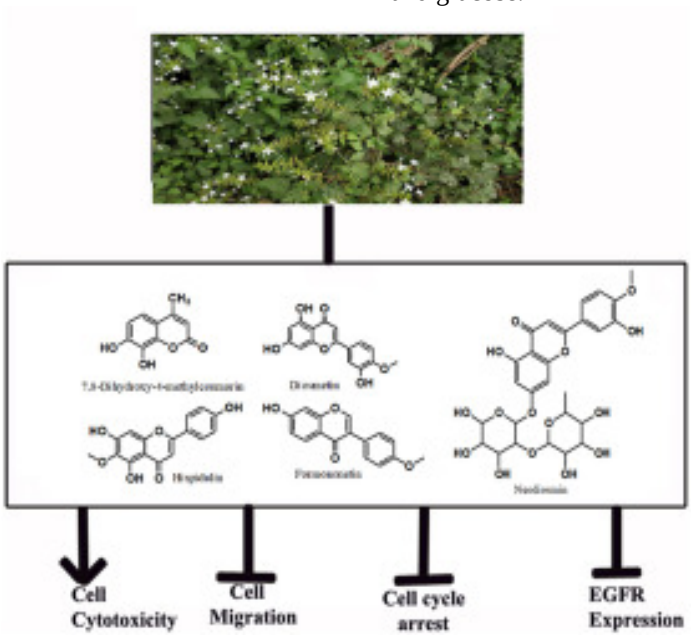
Leaves: Leaves contain plumbagin, chitanone.

Flower: Flowers contain plumbagin, zeylanone, and glucose.



PHARMACOLOGICAL ACTIVITIES

The plant P. zeylanica exhibits large numbers of medicinal properties which are describes as under-

Anti-inflammatoty activity

Plumbago species are one of the most important medicinal plants which are used for anti-inflammatory diseases. The root of P. zeylanica extracted with methanol was used for determining the anti inflammatory effects.[10] The methanolic extracts at 300 and 500 mg/kg produced 31.03 and 60.3% inhibition of acute inflammation, respectively, in Carrageenin induced raw paw oedema confirming that P. zeylanica roots are effective against acute inflammation.[11] In Ethiopia, the powdered bark, root or leaf is used to treat gonorrhea, syphilis, and tuberculosis. The Zambians make use of the roots boiled in milk as a remedy for inflammation of the mouth, throat and chest. Sheeja et al.,**5** studied the anti-inflammatory of various leaf extracts of P. zeylanica using in vivo experimental models.[12[The acetone extract

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significantly ($p < 0.01$) reduced inflammation in the carrageenan induced rats when compared to the control group. Yedapo**6** investigated the phosphate buffered saline extract of the roots of P. zeylanica for anti-inflammatory activity. The plant has been used for anti-inflammatory properties.[13]

Anti-bacterial activity The alcoholic extract from roots of Plumbago zeylanicawas tested against multi-drug resistant of clinical origin (Salmonella paratyphi, Staphylococcus aureus, Escherichia coli and Shigella dysenteriae). The extract exhibited strong antibacterial activity against all tested bacteria.[14]

Antioxidant activity Zahin et al. (2009) carried out in vitro antioxidant activity and total phenolic content of methanolic extracts of P. zeylanica (root), A. calamus (rhizome), H. indicus (stem) and H. antidysenterica (bark). The order of antioxidant potential according to FTC assay was found to be highest in P. zeylanica. Natarajan et al. (2006) carried out antioxidant activity.[15]

Antimalarial Activity: Plumbagin shows antimalarial effects on Plasmodium falciparum enzyme, the succinate dehydrogenase (SDH). The activity has been 50% inhibited by the naphthoquinone plumbagin at an inhibitory concentration of 5mM. It also inhibited the in vitro growth of the parasite with a 50% inhibitory concentration of 0.27mM.

Antiviral activity: The antiviral activities of the 80% methanolic extracts of Plumbago zeylanica have been examined against coxsackievirus B3 (CVB3), influenza A virus and herpes simplex virus type1 Kupka (HSV-1) using cytopathic effect (CPE) inhibitory assays in HeLa, MDCK, and GMK cells, respectively. The antiviral activity of the most active compound was confirmed with plaque reduction assays. In addition, CVB3 was inhibitedby the extracts of Plumbago zeylanica.[16]

Antidiabetic activity Christudas Sunil and et al. also evaluated the antidiabetic effects of plumbagin isolated from P.zeylanica root and its effect on GLUT4 translocation in TZ-induced diabetic rats.[17]

Antifungal Activity Alcoholic extracts of Plumbago zeylanica showed strong antifungal against the pathogenic yeast, Candida albicans and dermatophytes, Epidermophyton floccosum, Microsporum gypseum and Trichophyton rubrum, Minimum inhibitory concentration (MIC) was found to be 4 mg/ml.[18]

Antiplasmodial Activity Plumbagin shows antimalarial effects on Plasmodium falciparum enzyme, the succinate dehydrogenase (SDH). The activity has been 50% inhibited by the naphthoquinone plumbagin at an inhibitory concentration of 5 mM. It also inhibited the in vitro growth of the parasite with a 50% in an inhibitory concentration of 0.27 mM.[19]

Hypo-lipidaemic activity Alpana (1996) studied effect of P. zeylanica in hyper-lipidaemic rabbits and its modification by vitamin E. There was significant reduction in serum total cholesterol, LDL cholesterol and triglyceride levels. Marked reduction was observed with the formulation of P. zeylanica and vitamin E. The total cholesterol/HDL and LDL/HDL cholesterol ratios were found significantly ($p<0.01$) decreased.[20]

Antiplasmodial Action

Study carried out in-vitro screening of Indian medicinal plants for antiplasmodial properties against Plasmodium falciparum. Of 80 analysed ethanol extracts, from 47 species, significant effects were found for 31 of the extracts one of that was P. zeylanica.[21]

Anticonvulsant Action

Study on pharmacological and clinical therapeutically uses of Ayurvedic medicinal plants, one of which was P. zeylanica. Leaf extract of this plant were evaluated for anticonvulsant Action using PTZ induced convulsion and maximum electro shocked induced convulsion. It was found that extract has no anticonvulsant Action.[22]

Blood coagulation Action

The structure of Plumbago zeylanica active principle compound is similar to that of vitamin K. The P. zeylanica extract (2 mg/kg body weight) and napthoquinone (2mg/kg body weight) given to individual groups were screened for Its effect on bleeding time (BT), clotting time (CT), prothrombin time (PT), platelet count and platelet adhesion in albino rats after 1-day, 15-day and 31-

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 2 Mar-Apr 2023, pp: 1264-1270 www.ijprajournal.com ISSN: 2249-7781

day treatment. There was no change observed in treated groups and control group but the platelet.[23]

Central nervous system activity

A study reported that hydro-alcoholic leaf extract of P. zeylanica were evaluated for its CNS activity and it was found that the extract showed significant CNS depressant activity with the muscle relaxant properties. Vishnukanta et al., also investigated the anti-convulsant activity of hydro-alcoholic leaf extract of P. zeylanica and results showed that it did not possess the anti-convulsant activity. [24-25]

Hypo-cholesterolemic activity

A clinical study carried by Sharma et al., which utilized the root extract of P.zeylanica containing Plumbagin, when administered to the hyper-lipidemic rabbits reduced the serum cholesterol and LDL by a 53% to 86% and 61% to 91% respectively. The compound Plumbagin restricts the cholesterol and triglyceride accumulation in the liver and aorta A study also reveals a significant decrease in the serum cholesterol, LDL, cholesterol and triglyceride when 500mg/kg ethanolic extract of P. zeylanica was administered to hyper-lipidemic rabbits.[26-27]

Anti allergic activity: 70% ethanol extract from Plumbago zeylanica stems (EPZ) dose-dependently inhibited systemic anaphylactic shock induced by compound 48/80 in mice, reduced homologous passive cutaneous anaphylaxis and skin reactions induced by histamine or serotonin in rats. EPZ (50 µg/ml) markedly increased intracellular cAMP content of rat mast cells. These findings demonstrate that EPZ inhibits mast cell-dependent immediate allergic reactions, which is probably mediated by reducing the release of mediators such as histamine from mast cells via elevating intracellular cAMP level and weakening the inflammatory action of mediators.[28]

Hyperglycaemia in rats, treated with ethanol root extract of Plumbago zeylanica: The effects of the ethanol extract of the root of Plumbago zeylanica were studied in the rat. The results show that thigh muscle hexokinase, phosphofructokinase, pyruvate kinase and lactate dehydrogenase activities were significantly reduced by 12.07%, 51.02%, 24.32% and 25.16% respectively in rats treated with the ethanol extract of Plumbago zeylanica when compared with the control. Serum pyruvate and lactate were significantly lowered in the experimental rats by 23.64% and 46.29%, respectively. The reduction in the activities of the key enzymes of glycolysis and its end-products suggests a reduction in flux across the glycolytic pathway in the extract-treated rats. This impairs with delivery and utilization of glucose.[29]

II. CONCLUSION:

In present review, we have made an attempt to congregate the botanical, phytochemical, pharmacological and ethno pharmacological information on Plumbago zeylanica. Survey of literature reveals the presence of naphthaquinone, plumbagin, chitanone, zelanone, flavonoids, terpenoids and steroids. Scientific research on this plant reported the antibacterial, antifungal, anticarcinogenic, analgesic and anti-inflammatory and antiallergic activity of various parts of this plant.

REFERENCES;

[1]. Paiva SR, Marques SS, Figueiredo MR and Kaplan MAC: Plumbaginale: A pharmacology approach. Floresta e Ambiente 2003 Jan/Jul; 10: 98-105.
[2]. Rabinarayan Acharya Shodhana: An Ayurvedic detoxification Technique and its Impacton certain Medicinal Plants. Central Council for Research in Ayurvedic Sciences, Department of AYUSH, Ministry of Health and Family Welfare, Government of India, New Delhi. 2014, pp.427-450.
[3]. Kaikulangara Ramavarier Ārogyakalpadrumam. 2011; 8:382.
[4]. Madhava Chetty K, Lakshmipathi Chetty M, Sudhakar A, Ramesh C. Ethno-medico botany of some aquatic Angiospermae in Chittoor district of Andhra Pradesh, India. Fitoterapia 1998; 69: 7-12.
[5]. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants. Council of Scientific and Industrial Research, New Delhi, India, 1956.
[6]. Kirtikar KR, Basu BD, An ICS. Indian medicinal plants. Dehradun, India: International Book Distributors, Vol. 1,1995; 371–72.
[7]. Satyavati GV, Gupta AK and Tondon N: Medicinal plants of India. Indian Council of Medical Research, New Delhi, 1st ed. (vol.2), 1987.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 2 Mar-Apr 2023, pp: 1264-1270 www.ijprajournal.com ISSN: 2249-7781

[8]. Vijver, LM, Antibacterial Activity In Roots of Plumbago zeylanica, Planta Med, 20, 1971, 8-13.
[9]. Aditi G, Medicinal plants used in traditional medicine in Jimma zone, South West Ethopia, Pharm. Biol., 37, 1999, 321-323.
[10]. Sheeja E, Joshi SB, Jain DC, Bioassay guided isolation of anti-inflammatory and antinociceptive compound from Plumbago zeylanica leaf, Pharma Biol., 48, 2010, 381-387.
[11]. Yedapo, Studies on bioactivity of the root extract of Plumbago zeylanica, Pharm. Biol., 34, 1996, 365-369.
[12]. Oyedapo OO, Studies on the bioactivity of the extract of Plumbago zeylanica, Phytother Res., 13, 1996, 346–348.
[13]. Reddy SJ, Rajeswara Rao P, Mada S. Reddy, Wound healing effects of Heliotropium indicum, Plumbagozeylanicum and Acalypha indica in rats, J Ethnopharmacol, 79, 2002, 249– 51.
[14]. Abdul KM, Rachender RP, Modulatory effect of plumbagin of macrophage functions in Balb/c mice. I. Potentiation of macrophage bactericidal activity Immunpharmacol, Pub Med, 30 (3), 1995, 231-236.
[15]. Zahin M, Aqil F, Ahmad I (2009). The in vitro antioxidant activity and total phenolic content of four Indian medicinal plants. Int. J. Pharma. Pharm. Sci., 1: 89-95.
[16]. Marian TG, Neubert R, Schmidt PC, Wutzler P and Schmidtke M: Antiviral activity of some Ethiopian medicinal plants used for the treatment of dermatological disorders. Journal of Enthnopharmacology 2006; 104 (1-2): 182-187.
[17]. Christudas S, Veeramuthu D, Paul A, SavarimuthuI, Antidiabetic effect of plumbagin isolated from Plumbago zeylanica L. root and its effect on GLUT4 translocation in streptozotocin-induced diabetic rats, Food and Chemical Toxicology, 50, 2012, 4356-4363.
[18]. Mehmood Z, Ahmad I, Mohammad F and Ahmad S. Indian Midicinal plant: A potential source for anticandidal drug. Pharmaceutical Biology 1999; 37(3):237-242.
[19]. Nguyen AT, Malonne H, Duez P, Faotre RV, Vanhaelen17. Paiva SR, Marques SS, Figueiredo MR, Kaplan MAC. Plumbaginale: A Pharmacological approach. Florestae Ambiente 2003; 10:98-105.
[20]. Alpana R (1996). Effect of Plumbago zeylanica in hyper-lipidaemic rabbits and its modification by vitamin E. Indian J. Pharmaco., 28: 161-166.
[21]. Simonsen HT, Nordskjold JB, Smitt UW, Nyman U, Palpu P, Joshi P, Varughese G In vitro screening of Indian medicinal plants for antiplasmodial activity. J. Ethnopharmacol., 2001; 74: 195-204.
[22]. Vishnukanta 1, Rana AC Evaluation of anti-convulasant activity of Plumbago zeylanica Linn leaf extract. Asian J. Pharm. Clin. Res., 2010; 3: 76-78.
[23]. R. Vijayakumar, M. Senthilvelan, R. Ravindran, R. SheelaDevi, Plumbago zeylanica action on blood coagulationprofile With and Without blood volume reduction, Vascular Pharmacology, 2006; 45(2): 86-90.
[24]. Vishnukanta, Rana AC. Evaluation of central nervous system activities of Plumbago zeylanica l. leaf extract. Pharmacologyonline, 2009; 2:575-585.
[25]. 28. Vishnukanta, Rana AC. Evaluation of anticonvulsant activity of Plumbago zeylanica Linn leaf extract. Asian Journal of Pharmaceutical and Clinical Research. 2010; 3(1):76-78.
[26]. Sharma I, Gusain D, Dixit VP. Hyplidaemic and antherosclerotic effects of plumbagin in rabbits. Indian Journal of Physiology and Pharmacology. 1991; 35:10-4.
[27]. 30. Ram A. Effect of Plumbago zeylanica in hyperlipidaemic rabbits and its modification by vitamin E. Indian Journal of Pharmacology. 1996; 28:161-166.
[28]. Dai Y, Hou LF, Chan YP, Cheng L and But PPH: Inhibition of Immediate Allergic Reactions by Ethanol Extract from Plumbago zeylanica Stems. Biology of Pharmaceutical Bulletin 2004; 27(3): 429-432.
[29]. Olagunja JA, Jobi AA and Oyedapo OO: An investigation in to biochemical basis of the observed hyperglycemia in rat treated with ethanol root extract of

Plumbago zeylanica. Phytotherapy Research 1999 Jun; 13(4): 346-348.

[30]. ThenukaH.G.M,Randula D.H,NiroskhanN.M ,PeirisM.M:Determination of antimicrobial properties of Plumbago zylanicaL.BacterialEmpire2022Sep;10(10):1-5.