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Pharmacognostical and phytochemical evaluation of Chitraka (*Plumbago zeylanica* Linn.)

Sadhana Singh, Apurva Priyadarshi, Satya Prakash Chaudhary, Brijesh Singh and Poonam Sharma

Abstract
Ayurveda is the oldest system of medicine and had a rich knowledge of the application of medicinal plants from very ancient times. The ancient scholars have mentioned properties of medicinal plants through their deep observation, analysis of observation and after words clinical assessment in patients. In this review Botanical description, chemical constituent, medicinal properties, formulation, dose, and pharmacological effects of *Plumbago zeylanica* are described. The present work deals with the pharmacognostical and preliminary phytochemical studies on root of *Plumbago zeylanica* Linn. Macroscopical and Microscopical Characters, physico-chemical constants, quantitative microscopy parameters, extractive values, TLC and HPTLC were studied. Preliminary phytochemical screening on root of *Plumbago zeylanica* were studied. The determination of these characters will help future researchers in their Phytochemical as well as Pharmacological analyses of this plant.

Keywords: *Plumbago zeylanica*, pharmacognosy, phytochemical, macroscopic, microscopic

Introduction

Botanical description

(According to Benthum & Hooker's system)

Kingdom	-	Plantae
Division	-	Phanerogames
Sub division	-	Angiosperms
Class	-	Dicotyledonae
Sub class	-	Gamopetalae
Series	-	Heteromerae
Order	-	Primulales
Family	-	Plumbaginaceae
Genus	-	*Plumbago* L.
Species	-	*zeylanica*

Citraka is perennial herb, sometimes in shady places; subscandent; stem 0.6-1.5 meter long, some what woody, spreading, terete, striate, glabrous. Leaves-thin, 3.8-7.5 by 2.3-3.8 mm, ovate, subacute, entire, glabrous, some what glaucous beneath, reticulately veined, shortly and abruptly attenuated into a short petiole, petiole narrow; amplexicaul at the base and there often dilated into stipule like auricles. Flowers in elongate spikes; rhachis glandular, striate; bracteoles ovate, acuminate, shorter than the calyx, glandular or not.

Dry root of citraka

Citraka

Flowering and fruiting time: Winter season and onwards.

Distribution: It is found throughout India; much cultivated in wild in the W. peninsula and probably in Bengal, Malay peninsula, Ceylon –tropics of the old world [1].

Chemical constituents of dried root of *Plumbago zeylanica* Linn.: Plumbagin, 3, 3-biplumbagin, 3-chloroplumbagin, chitranone, plumbagicacid, elliptinone, droserone, isoshinanolone, maritinone, 4-naphthoquinone, suberosin, Xanthyletin and xanthoxyletin) [2].

Pharmacology: Phosphate buffered saline extract of the root of *P. zeylanica* showed anti-inflammatory activity in formaldehyde-induced arthritic rats [3]. Ethanolic extract showed hyperglycaemic effect [4], while 50 per cent ethanolic extract showed central nervous system stimulatory action in rats [5]. Root powder caused abortions [6] and preimplantationary loss due to its effect on uterine protein content [7]. Antibacterial activity was reported in petroleum ether, chloroform and ethanolic extracts of root but not in the aqueous extract [8]. Root powder also showed digestive and appetizing property by normalizing the intestinal flora in mice [9]. Crude and ethanolic extract also showed metabolic effects in rat liver [10]. Plumbagin, a anthraquinone isolated from the root showed hypolipidaemic and antiatherosclerotic effect in rabbits [11]. Plumbagin showed strong antiprogestational activity in rats [12]. It showed antitumour activity in mice [13] and regression of experimental tumours [14]. Plumbagin showed antimicrobial activity and when administered with antimicrobials like streptomycin/ rifampicin delayed the development of resistance by sensitive strain of Escherichia coli and staphylococcus aureus [15].

Major therapeutic claims: In colic and as an appetizer [16]

Safety aspects: The drug used traditionally in prescribed doses may be considered safe.

Dose

Powder-1 to 2 g [17]

Formulations & Preparations: Yogaraja guggulu vati, Saptavimshatika guggulu vati, Punarnava guggulu vati, Panchatikta guggulu ghrita, Vyoshadi guggulu vati, Chitrakadi vati, Chitrakadi Choorna, Agnitundi vati, Mustadi, Amalakyadi, Panchakola, Shadushana, Chitrakadi leha, Saddharana yoga, Chitraka rasayana, Amritashatapatalaghritam, Abhayarishta, Tejovatyadi ghrita, Chitrakadi avaleha, Ajamodadi Choorna.

Material and Method

Powder microscopy of root powder of Citraka

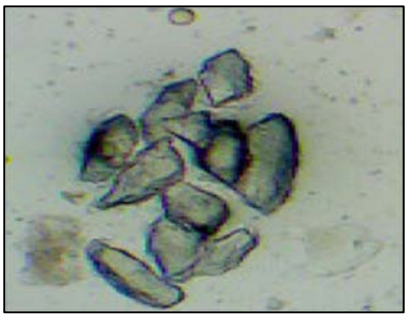
Coarse powder of dull dark brown to dark reddish in colour. In microscopic powder study it shows Lignified xylem and medullary rays of pink to purple colour and calcium oxalate crystals of grey in colour. Simple and compound starch grains with distinct hilum embedded in parenchymatous cells scattered as such throughout the powder.

Microscopical Characteristics of Powdered Citrak (*Plumbago zeylanica*) Root

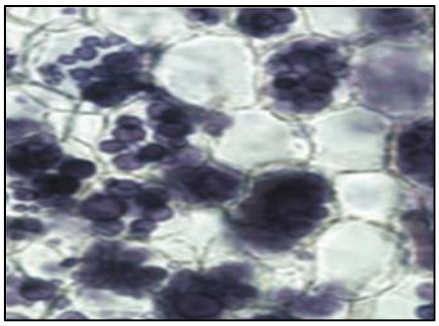
S. No.	Reagents	Observations	Characteristics
1.	Phloroglucinol+Conc. HCL	Pink	Lignified xylem and medullary rays
2.	Dil. Iodine solution	Blue	Starch
3.	Dil. Sulpuric Acid	White	Calcium oxalate crystals
4.	Acetic acid	White	Calcium oxalate crystals
5.	Dil. Hydrochloric acid	White	Calcium oxalate crystals

Powder microscopy of citrak (*Plumbago zeylanica*) Root

Lignified Xylem



Calcium oxalate crystals



Starch

Citraka

Table 1: Certificate of Analysis of Citraka

S. No.	Parameters	Observation
I	Physical tests	
	Nature	Coarse powder
	Colour	Brown
	Odour	Disagreeable
	Taste	Acrid
II	Foreign matter	0.5%
III	Moisture content (w/w%)	10.71
IV	Ash value (% w/w)	
	Total ash	2.05
	Acid insoluble ash	0.15
	Water soluble ash	0.77

Table 2: Percentage yield of extracts of citraka

S. No	Extracts	Nature of Extract	Weight (gm)	% Yield w/w
I	Hydro-alcohol	Viscous	18.120	18.12

Genuine sample of Citraka gave the presence of following phytochemicals.

Phytoconstituents	
Alkaloids	+
Glycosides	+
Flavonoids	+
Steroid	-
Phenolic & tannins	+
Terpenoid	-
Sterol	+
Carbohydrates	+
Proteins	+
Amino Acids	-

(+) indicate present, (-) indicate absent

Thin layer chromatography (TLC) of extracts

TLC or Thin Layer Chromatography is a type of planar chromatography. TLC is routinely used by researcher in the field of phyto-chemicals, biochemistry etc. to identify the components in a compound mixture like alkaloids, phospholipids, amino acids etc. It is a semi quantitative method of analysis and its sophisticated version. Similar to other chromatographic methods TLC is also based on the principle of separation. The separation depends on the relative affinity of compounds towards stationary and mobile phase. The compounds that under the influence of mobile phase (driven by capillary action) travel over the surface of stationary phase. During this movement the compounds with higher affinity to stationary phase travel slowly while the others travel faster. Thus separation of components in the mixture is achieved. Once separation occurs individual components are visualized as spots at respective level of travel on the plate. Their nature or characters are identified by means of suitable detection techniques. TLC System consists of a TLC plates preferably readymade with stationary phase: These are stable and chemically inert plates on to whose surface a thin layer of stationary phase is applied. The stationary phase on the plates is of uniform thickness and consists of fine particle size.

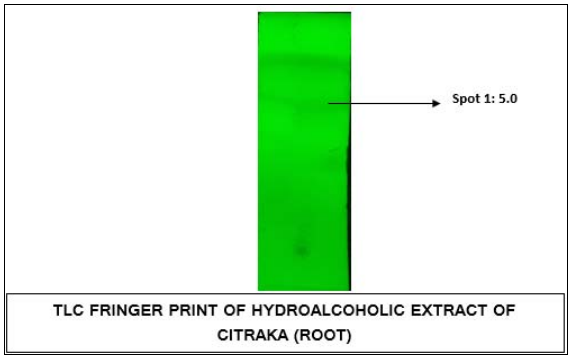
$$R_f \text{ value} = a/b$$

= Distance travelled by the solute/ Distance travelled by the solvent
a= Distance travelled by the solute
b= Distance travelled by the solvent

TLC of Hydro alcoholic extract of Citraka (root)

Mobile phase: A mixture of 6 ml of Toluene, 6 ml of Ethyl acetate, 1.8 formic acid, 0.25 methanol.

Heat: Heat at 110 °C for 10 minutes and examines the plate under day light.



Solvent system [Toluene: Ethyl acetate: formic acid: methanol (6:6:1.8:0.25)]

For Spot 1

$$\text{Rf Value} = \frac{5.0}{6.9}$$

$$= 0.72$$

HPTLC (High performance thin layer chromatography) Methodology

- 0.3g of extract was dissolved with 1 ml of water and 1ml of ethyl alcohol and 3, 6 and 9µl of the above extract was applied on a pre-coated silica gel F254 on aluminum plates to a band width of 7 mm using Linomat 5 TLC applicator.
- The plate was developed in Toluene: Ethyl-acetate: formic acid: methanol (6:6:1.8:0.25). The developed plates were visualized in UV 254 and 366 and scanned under UV 254 and 366 nm. R_f, of the spots and densitometric scan were recorded.

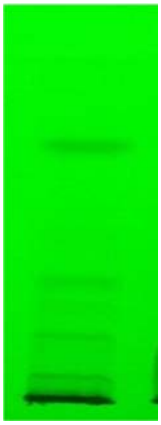
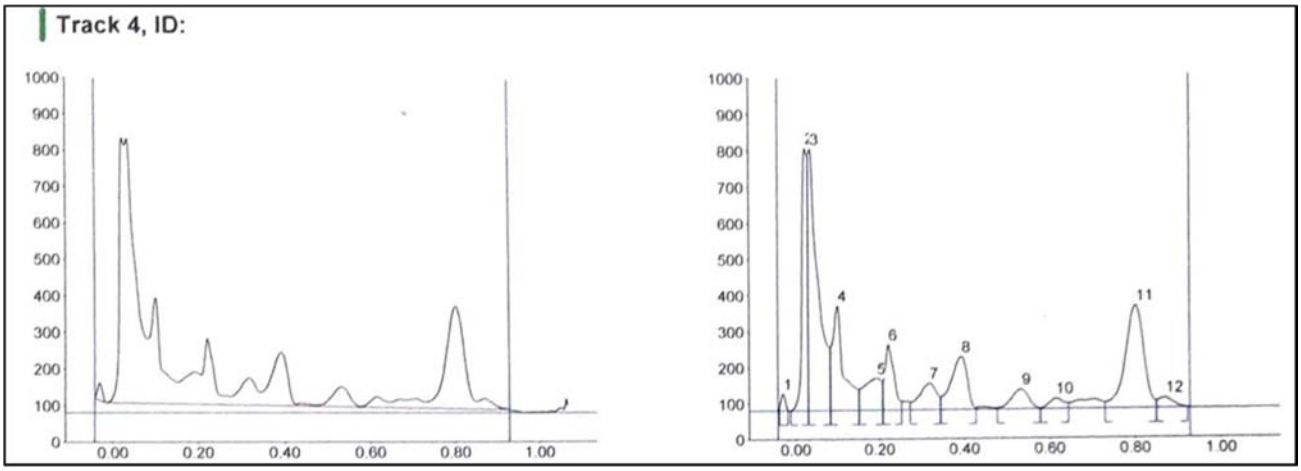


Fig: HPTLC chromatogram of hydroalcoholic extract of citraka (Root) and amalakyadi gan



HPTLC chromatogram of hydroalcoholic extract of citraka (Root)

Track 4, ID

Peak	Start Rf	Start Height	Max Rf	Max Height	Max %	End Rf	End Height	Area	Area %
1	-0.04	10.6	-0.03	47.3	1.76	-0.02	1.3	444.4	0.78
2	-0.01	1.9	0.02	729.0	27.18	0.03	707.8	8011.2	14.02
3	0.03	711.1	0.04	726.2	27.07	0.08	177.0	14471.1	25.33
4	0.08	177.6	0.10	290.3	10.82	0.15	60.3	6640.0	11.62
5	0.15	60.1	0.19	88.9	3.31	0.21	79.9	3181.6	5.57
6	0.21	81.0	0.22	181.8	6.78	0.25	25.7	32.19.4	5.64
7	0.27	22.4	0.32	74.8	2.79	0.34	35.7	2547.1	4.46
8	0.35	35.9	0.39	146.8	5.47	0.43	5.0	4721.7	8.26
9	0.48	4.3	0.54	55.6	2.07	0.58	2.4	1879.4	3.29
10	0.58	2.5	0.62	29.5	1.10	0.65	15.5	857.4	1.50
11	0.73	17.5	0.80	282.8	10.54	0.85	21.4	10265.4	17.97
12	0.85	21.6	0.87	29.7	1.11	0.93	1.7	891.0	1.56

Discussion and Conclusion

'Pharmacognosy' is meant by identification of drugs by its every aspect, habit, cultivation, procurement, micro and macroscopic characters, physical and chemical properties etc. In present study pharmacognostical standards have been established with regards to root of *Plumbago zeylanica*. Powder microscopy of root of *Plumbago zeylanica* showed the presence of Lignified xylem, medullary rays, calcium oxalate crystals and parenchymatous cells.The physical evaluation furnished different ash values, extractive values in different solvents. Total ash, acid insoluble ash and water soluble ash values were also calculated. The phytochemical investigation shows the presence of Alkaloids, Glycoside, Flavonoids, tannins, sterol, Carbohydrates, Protein, Tannins and Phenolic Compounds in the root of *Plumbago zeylanica*. Study was carried out in order to assess the quality of root of *Plumbago zeylanica* and also to detect the adulteration and substitution etc., which may be helpful to researchers in future.

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