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Phenol content and total *in vitro* antioxidant capacity of the roots of different *Plumbago* species found in Kerala

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Abstract: *Plumbago* famous in Ayurveda as 'Chitrak' is a highly important herbal raw drug in the Indian traditional system of medicine. Root is the medicinal part an essential ingredient in ayurvedic formulations like chitrakati vati and chitrakad choornam. Three different major species of *Plumbago* namely *Plumbago rosea*, *Plumbago zeylanica* and *Plumbago capensis* are found commonly in Kerala which possess one or other therapeutic effect. Free radicals or highly reactive oxygen species induce oxidative damage to human body and antioxidants are the compounds which terminate the attack of reactive species and reduce the risk of diseases. In this study the objective was to evaluate the total phenol content as well as the total *in vitro* antioxidant capacity of the roots of different *Plumbago* species. Study revealed that all the roots were having good quantity of phenol but in varying amounts. *In vitro* antioxidant activity of the extracts were found positively associated with the total phenol content present in the species.

Keywords: Antioxidant, phenol, *Plumbago rosea*, *Plumbago zeylanica*, *Plumbago capensis*

INTRODUCTION

Free radicals or highly reactive oxygen species induce oxidative damage to human body and antioxidants are the compounds which scavenge and terminate the attack of reactive species and reduce the risk of diseases. Most of the medicinal plants are rich in phenolic compounds and antioxidants. *Plumbago* is

an important herbal raw drug in the Indian traditional system of medicine famous as 'Chitrak'. It is widely cultivated throughout India and Sri Lanka. The plant belongs to the family *Plumbaginaceae* and is locally known as Chitrak in Hindi, Leadwort in English and Koduveli in Malayalam. Root is the medicinal part. *Plumbago* is an esteemed remedy for leucoderma

and other skindiseases. Roots are antioxidant, rejuvenating, acrid, astringent, anti inflammatory, digestive, gastric and nervous stimulant. Plumbago root is an essential component in many ayurvedic formulations like chitrakati vati, chitrakati churna and chitraka harithaki. Plumbagin (5-hydroxy-2-methyl-1,4-naphthoquinone), chemically a naphthaquinone, is the major therapeutically active chemical component present in the roots of plumbago. Commonly three different major species of Plumbago namely *Plumbago rosea*, *Plumbago zeylanica* and *Plumbago capensis* are found in Kerala. Their flowers are red, white and blue in colour respectively hence named as red chitrak, white chitrak and blue chitrak. *Plumbago rosea* is the most preferred species by the Ayurvedic vaidyas of Kerala [1]-[4]. The present study is an attempt to assess the phenol content as well as the *in vitro* total antioxidant capacity of the roots of these three different species of Plumbago and to document the findings.

MATERIALS AND METHODS

The study was carried out at All India Coordinated Research Project on Medicinal and Aromatic Plants and Betelvine, College of Horticulture, Kerala Agricultural University, Vellanikkara. Three different species of chitrak were grown in the experimental field, irrigated regularly and applied with FYM as per Package of Practice recommendations of Kerala Agricultural University. Rooted stem cuttings were used for planting. The plants were uprooted and harvested at same time at maturity after eighteen months after planting and roots were collected, cleaned and subjected to shade drying for about two weeks. The shade dried plant material was further crushed to fine powder and the powder was passed through the mesh 22 and used for chemical analysis.

Estimation phenol content

The total phenols were determined by method as referred in Harbone (1973) [5]. Gallic acid

monohydrate was used as the standard. The concentration of total phenol in the sample was determined from the calibration graph and expressed in percentage.

Evaluation of total antioxidant capacity

The antioxidant capacity was estimated by phosphomolybdenum method of Prieto *et al*, 1999. The assay is based on the reduction of Mo (VI) to Mo (V) by the extract and subsequent formation of a green phosphate/Mo (V) complex at acidic pH [6]. The antioxidant activity was expressed as ascorbic acid equivalent (mg AAE/g extract) which served as a positive control.

RESULTS AND DISCUSSION

Three different species of Plumbago are found in Kerala with synonyms and local names as in Table 1 & Figure 1.

Table 1
Three different species of Plumbago under study

Sl. No:	Botanical name	Synonyms	Local name in Malayalam
1	<i>Plumbago rosea</i> Linn.	<i>Plumbago indica</i>	Chethi koduveli
2	<i>Plumbago zeylanica</i> Linn.	<i>Plumbago viscosa</i>	Vella koduveli
3	<i>Plumbago capensis</i> Thumb.	<i>Plumbago auriculata</i>	Neela koduveli

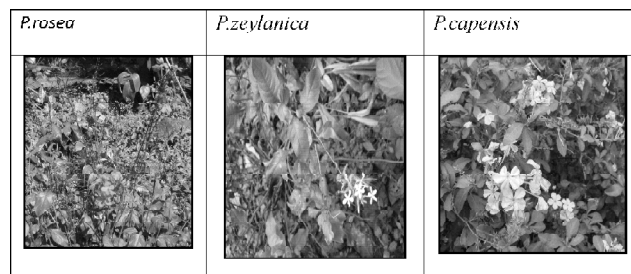


Figure 1: Three different species of Plumbago found in Kerala

Free radicals cause many transformations, mutations and diseases in many organisms. Antioxidants which scavenge these free radicals are hence very important in food as well as in medicines to prevent the damages due to free radicals. Phenolic compounds are considered to be the most important antioxidants and are widely distributed among various plant species. These phenols play important roles in plants such as protection against herbivores and pathogens [7]. In this study total phenolic content for the root extract was found highest *Plumbago rosea* roots followed by *P.capensis*. Lowest found in *P. zeylanica* (Table 2).

Total antioxidant capacity is a better way of depiction of combined effect of phenolics, flavonoids, alkaloids and other reducing compounds in the plant extracts and is expressed in terms of ascorbic acid equivalents (AAE) [7]-[8]. The plumbagin content and total antioxidant capacity were found highest in *Plumbago rosea* followed by *Plumbago capensis*. Lowest found in *Plumbago zeylanica* (Table 2).

Table 2
Phenol and antioxidant capacity (mgAAE/g) of plumbago root extracts

Sl.No: Sample	Phenol content (%)	Antioxidant capacity (mgAAE/g)
1 <i>P.rosea</i>		1.9
2 <i>P.zeylanica</i>		1.4
3 <i>P.capensis</i>		1.5

*Ascorbic acid equivalent (AAE).

CONCLUSION

On the basis of the results obtained in the present study, it is concluded that *Plumbago* roots (all three species) contain high amount of phenolic compounds and exhibit high antioxidant activities. Phenol is present in all, but more in *P.rosea*. A high

correlation is found between the total phenolic content with the *in vitro* antioxidant activities. These plant roots prove to be good source of antioxidants, which might be useful in preventing the progress of various oxidative conditions. However, further phytochemical analysis is required for detailing more bioactive molecules from these plants that may show a broad spectrum of pharmacological activities.

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