



QUANTIFICATION OF PRIMARY AND SECONDARY METABOLITES FROM LEAVES AND STEM BARK OF *COCHLOSPERMUM RELIGIOSUM* (L) ALSTON

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ABSTRACT

Phytochemical constituents are responsible for medicinal activity of plant species. Hence the present study quantification of primary and secondary metabolites from leaves and stem bark of *Cochlospermum religiosum* was carried out. The results showed that the leaf was rich in chlorophylls followed by lipids, proteins and carbohydrates whereas in stem bark highest amount found in chlorophylls followed by carbohydrates, proteins and lipids of primary metabolites. *Cochlospermum religiosum* leaf was rich in phenols followed by alkaloids, flavonoids and tannins whereas in stem bark highest amount found in phenols followed by flavonoids, alkaloids and tannins of secondary metabolites. The results suggest that phytochemical properties for curing various ailments and possess potential antioxidant, anti-inflammatory, antimicrobial and leads to the isolation of new and novel compounds.

Keywords: *Cochlospermum religiosum*, primary metabolites, secondary metabolites, leaves, stem bark, Phenols.

INTRODUCTION

Cochlospermum religiosum (L) Alston is a sparsely branched small tree, belonging to the family Cochlospermaceae. It is commonly called as Yellow Silk Cotton, Buttercup Tree and Torchwood Tree because of flowers are large, bright golden yellow and seeds covered with silky hairs. *Cochlospermum religiosum* stem bark and root powder is traditionally used for fertility and ash of fruit mixed with coconut is used for the treatment of scabies¹. The gum of *Cochlospermum religiosum* is also found to be an ingredient of unani medicine Qurs-e-Sartaan Kafoori which is used for Styptic, Antipyretic, Phthisis, Tuberculosis, Hectic fever and Qurs-e-Suzak Cicatrizing, Diuretic, Gonorrhoea. These formulations were found to possess good antibacterial and antifungal activity². Sasikala and Savithramma³ studied the antimicrobial activity of biological synthesis of silver nanoparticles from leaves of *Cochlospermum religiosum* and also studied the preliminary phytochemical screening and found flavonoids, steroids, tannins, glycosides, alkaloids, phenols etc. in different solvents⁴. Plant synthesizes a wide variety of chemical compounds which can be sorted by their chemical class, biosynthetic origin and functional groups into primary and secondary metabolites. Primary metabolites directly involved in growth and development of plants. These are widely distributed in nature, occurring in one form or another in virtually all organisms. They are like chlorophyll, amino acids, nucleotides and carbohydrates have a key role in metabolic processes such as photosynthesis, respiration and nutrient assimilation. They are used as industrial raw material and food additives. Many plants such as *Nerium indicum*⁵, *Gloriosa superba*⁶, *Ricinus communis* and *Euphorbia hirta*⁷, *Pongamia pinnata*⁸ and *Moringa oleifera*⁹ have been evaluated for their composition of primary metabolites. Secondary metabolites are the basic source for the establishment of several pharmaceutical industries. The constituents present in the plants play a significant role in the identification of crude drugs. Phytochemical screening is very important in identifying new sources of therapeutically and industrially important compounds like alkaloids, flavonoids, phenolic compounds, steroids etc¹⁰. Previously the crude drugs were identified by comparison only with the

standard descriptions available, but recently due to advancement in the field of pharmacognosy various techniques have been following for the standardization of crude drugs. Several plants are studied for quantification of secondary metabolites in *Svensonia hyderabadensis*¹¹, *Boswellia ovalifoliolata*¹², *Shorea tumbuggaia*¹³, *Jatropha*¹⁴, *Clerodendron colebrookianum* and *Zingiber cassumunar*¹⁵ and *Spondias mombin*¹⁶. In the present study quantification estimation of primary and secondary metabolites from leaf and stem bark of *Cochlospermum religiosum*.

MATERIALS AND METHODS

Collection of plant material

Fresh leaves and stem bark of *Cochlospermum religiosum* was collected from the Tirumala hills and different locations of Chittoor district, Andhra Pradesh, India during the month of December, 2012. The leaves and stem bark were washed thoroughly 2-3 times with running tap water and then air dried under shade after complete shade drying the plant material was used for phytochemical analysis.

Quantification of Primary and Secondary Metabolites

Quantification of primary and secondary metabolites were carried out by the following methods of proteins¹⁷, carbohydrates¹⁸, lipids¹⁹ and chlorophylls²⁰; phenols and tannins²¹, flavonoids²² and alkaloids²³.

RESULTS AND DISCUSSION

Quantification of Primary metabolites

In the present study, quantification of primary metabolites in leaves and bark of *Cochlospermum religiosum* has been undertaken, the results are present in Table 1. The total lipids of 0.2 ± 0.057 mg / gdw are found in leaves and 0.04 ± 0.00 mg / gdw in bark. The higher amount of plant lipid can be used as essential oils, spice oleoresins and natural food colors, with a strong foundation in research and development. Plant lipids are products that work with diverse requirements, as culinary, medicinal and cosmetics²⁴. The leaves showed 0.075 ± 0.03 mg / gdw of carbohydrates and bark 0.110 ± 0.02 mg / gdw. Starch is biodegradable and renewable in nature, they are increasingly being considered as an eco-

friendly alternative to the use of synthetic additives in many other products, including plastics, detergents, pharmaceutical tablets, pesticides, cosmetics and even oil-drilling fluids²⁵. Plant sugars can be used as artificial sweeteners and they can even help diabetes by supporting the body in its rebuilding²⁶. Proteins are the primary components of living organisms. The presence of higher protein levels in the plants increase food value or that a protein base bioactive compound could also be isolated in future²⁷. Total protein content of 0.151 ± 0.007 mg / gdw is found in the leaves and 0.068 ± 0.009 mg / gdw in the bark of *Cochlospermum religiosum*. The quantitative estimation of total chlorophyll content found in leaves of *Cochlospermum religiosum* is 0.34 ± 0.04 mg / gdw and in bark is 0.14 ± 0.04 mg / gdw. Chlorophyll is the most indispensable class of primary compounds as they are the only substances that capture sunlight and make it available to plant system for its cultivation of photosynthesis²⁸ (Graph-1).

Quantification of Secondary Metabolites

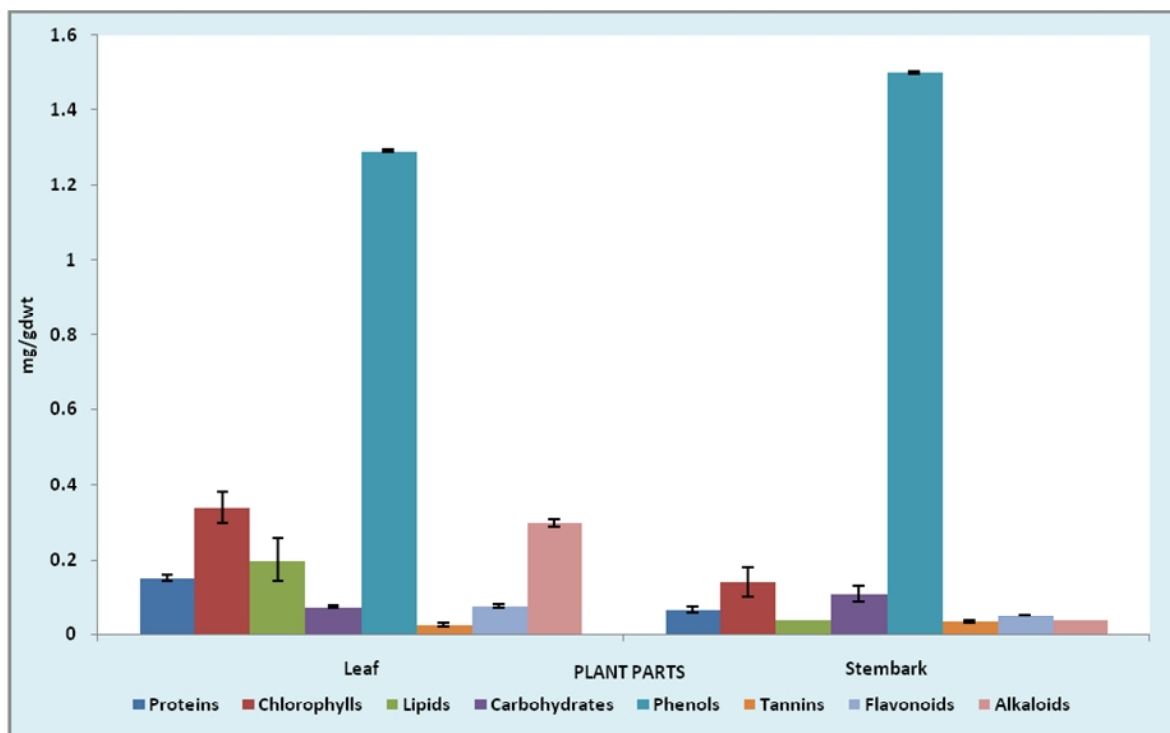
The general assessment of the analytical results for different parts of *Cochlospermum religiosum* showed individual specificity of each studied parts and rich diverse spectrum of secondary metabolites differing from one another. The highest total flavonoid content was found in leaves (0.077 ± 0.04 mg / gdw) followed by bark (0.052 ± 0.002 mg / gdw) (Table 1 and Graph-1). Similar results were recorded from *Urtica dioica* and *Equisetum maximum*²⁹. Flavonoids are plant secondary metabolites widely distributed in the plants and more than 6000 flavonoids have been identified in plants³⁰. Flavonoids are a group of poly phenolic compounds with known properties which include free radical scavenging inhibition of hydrolytic and oxidative enzymes and anti-inflammatory action³¹. These are vital in combating the free radicals which damage human cells³². Numerous epidemiological studies confirm significant relationship between the high dietary intake of flavonoids and the

reduction of cardiovascular and carcinogenic risk³³. There have been an increasing number of reports that directly contradict the putative role of flavonoids as antioxidant and anti-cancer agents³⁴. The highest total phenolic content was found in bark (1.5 ± 0.002 mg / gdw) followed by leaf (1.29 ± 0.045 mg / gdw). Similar results were reported from *Mellilotus officinalis*²⁹. A number of data showed that the presence of phenolics in food is particularly important for their oxidative stability and antimicrobial protection³⁵. Phenols are ubiquitous secondary metabolites in plants and comprise a large group of biologically active ingredients. Around 8000 compounds of phenols have been identified so far in plants³⁶. These phenolic compounds possess a wide spectrum of biochemical activities such as antioxidant, antimutagenic, anticarcinogenic as well as ability to modify the gene expression³⁷. The highest total tannins content was found in bark (0.034 ± 0.002 mg / gdw), followed by leaf (0.026 ± 0.03 mg / gdw). Tannins are widely distributed in almost all plant foods³⁸. The tannin containing remedies are used as antihelminthic³⁹, antioxidants, antimicrobial and antiviral⁴⁰. The highest total alkaloids content was found in leaf (0.3 ± 0.011 mg / gdw) followed by bark (0.04 ± 0.00 mg / gdw).

Table 1: Quantitative Analysis of Phytochemical Constituents from Leaves and Stem Bark of *Cochlospermum religiosum*

Phytochemical Name	<i>Cochlospermum religiosum</i>	
	Leaf (mg / gdw)	Stem bark (mg / gdw)
Proteins	0.151 ± 0.007	0.068 ± 0.009
Chlorophylls	0.34 ± 0.04	0.14 ± 0.04
Lipids	0.200 ± 0.057	0.040 ± 0.000
Carbohydrates	0.075 ± 0.030	0.110 ± 0.020
Phenols	1.290 ± 0.045	1.500 ± 0.002
Tannins	0.026 ± 0.030	0.034 ± 0.002
Flavonoids	0.077 ± 0.040	0.052 ± 0.002
Alkaloids	0.300 ± 0.011	0.040 ± 0.000

Note: '±' indicates standard error



Graph 1: Quantitative Analysis of Phytochemical Constituents from Leaves and Stem Bark of *Cochlospermum religiosum*

The alkaloids are one of the most diverse groups of secondary metabolites found in living organisms and have an array of structure types, biosynthetic pathways, and pharmacological activities. Anti-diarrhoeal activity of Piperine, the principal alkaloids of *Piper longum* and *Piper nigrum*, was investigated against diarrhoea⁴¹, imidazole alkaloid, chaksine isolated from *Cassia abtusa* has antibacterial activity⁴² and leaf extract of *Ricinus cummunis* was evaluated for hepato protective choleric and anticholestatic activity⁴³. Total alkaloids of *Eclipta alba* have been reported have significant analgesia used⁴⁴. Based on the results chlorophylls and phenolic compounds are highest in leaves and stem bark of *Cochlospermum religiosum*, followed by other primary and secondary metabolites.

CONCLUSION

In the present study, *Cochlospermum religiosum* contains many primary and secondary metabolites like proteins, lipids, starch, sugar, phenols, alkaloids, flavonoids, tannins and steroids. Highest amount of phenols of secondary metabolites were found to be rich in leaves and bark of *Cochlospermum religiosum*. These results are suggestive of primary and secondary bioactive compounds are commercially and pharmaceutically important. Analysis of plants primary metabolites is necessary for knowing the nutritional potential and secondary metabolites for medicinal value.

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