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The Structural Analysis Of Plant Constituents Of Pterospermum Acerifolium

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Abstract – India, with a rich history & legacy of Ayurveda, has been using this ancient repository of plants and their extracts for their medicinal properties. The objective of this study is to study the key chemicals and evaluate the potential of Pterospermum acerifolium bark for their medicinal properties. P. acerifolium is found in regions across the sub-Himalayan tract and outer Himalayan regions in India.
The bark extracts were found to have alkaloids, flavonoids, phenolic compounds, saponins, tannins, glycosides etc. The study also isolated three compounds from the bark which were identified to be flavonoids.
These constituents have been known to show different medicinal properties for humans and their presence clearly indicates that extracts from P. acerifolium can be leveraged for obtaining novel compounds for the treatment of infectious diseases.
Keywords: Pterospermum acerifolium; plant extracts; phytochemicals; medicinal plants

1. Introduction

The history of medicine in India can be traced as back as to vedic times. In the Rigveda (4500 B.C. to 1600 B.C.) perhaps the oldest repository of human knowledge and Atharvaveda, we find the mention of different types of medicines prepared from the extracts of different plants. In other works of later vedic period particularly in Ayurveda, the proportion of various drugs have been given in detail. [1] Later on, during Buddhist period, considerable progress was made and medicinal plants were cultivated under the direction and supervision of qualified specialists. Contacts with Greece, Rome and later with Arabia & Persia contributed to the enrichment of Indian materia-medica and a large number of herbs and natural products came into use for treatment of diseases.

Many of the pharmaceutical drugs are derived directly or indirectly from plants. This shows that at least a few plants have compounds that can be harnessed for their medicinal uses. Keeping in mind that we still haven't fully documented the properties of all plants, this number may be even higher. To scientists, plants are a mixture of mainly unwanted constituents which need to be refined, isolated & identified as 'actives' and others. This process also helps to identify chemicals with potential for adverse effects on the pharmaceutical activity of drugs.

Medicinal properties of plants depend upon the presence of one or more physiologically active compounds because in addition to physiologically active constituents, it might also contain some toxic substances injurious to the body. It therefore becomes necessary to isolate the physiologically active principles from plants in pure form and to study their exact composition and structure by chemical examination and then subject them to physiological tests.

The plant pterospermum acerifolium belongs to the natural order sterculiaceae. Pterospermum is a large genus of shrubs and trees having many species. A number of species of this group are of medicinal value. The plant is commonly spread out across many regions in India – the sub-Himalayan tract and outer Himalayans valleys and hills up to 4000 ft. Bengal, Chittagong, Khasi hills, Manipur, Burma, North Konkan extensively planted in Mumbai. It is a large tree with smooth bark, ash-coloured young parts clothed with floccose pubescene with fragrant flowers & ripe fruits which remain on the tree for a long time.

The flower is sharply bitter, acrid, tonic, laxative, anthelmintic removes "Kapha", inflammation, blood troubles, abdominal pain, ascites, cures ulcers, leprosy, urinary discharges and tumors (Ayurvedic). [2] The down on the leaves is used to stop bleeding in wounds. The flowers are also used as a general tonic. Stem/bark of the plant is also reported to have antimicrobial activity and a possible source of bioactive secondary metabolites. [3]

2.Materials & Methodology

Dried bark of Pterospermum-aceriflium was extracted with ethanol in a round bottomed flask 6 hours daily for 15 days over an electric water bath. The extract was filtered while hot and kept overnight at room temperature. A light brown deposit settled down at the bottom of the flask. This deposit was filtered off and was kept aside for further analysis. The filtrate obtained after separation of the light brown deposit was concentrated to half of its volume and was kept in a refrigerator for 2 days. A similar deposit appeared which was filtered and mixed with the first deposit.

The filtrate after the separation of the deposit was concentrated to half of its volume and poured into excess of distilled water with continuous stirring using a mechanical stirrer. After a few hours the resulting precipitate was filtered. Thus, three portions, the brown-coloured deposit, the red-colored water insoluble portion and the water-soluble portion were obtained. These were handled separately.

The brown-coloured deposit obtained from the concentrate of ethanolic extract was further purified by refluxing it with methanol. The methanol soluble fraction when examined chromatographically using silica gel G thin layer chromatoplates was found to contain a mixture of several organic compounds. The separation and identification of the compounds could not be carried out due to paucity of the materials.

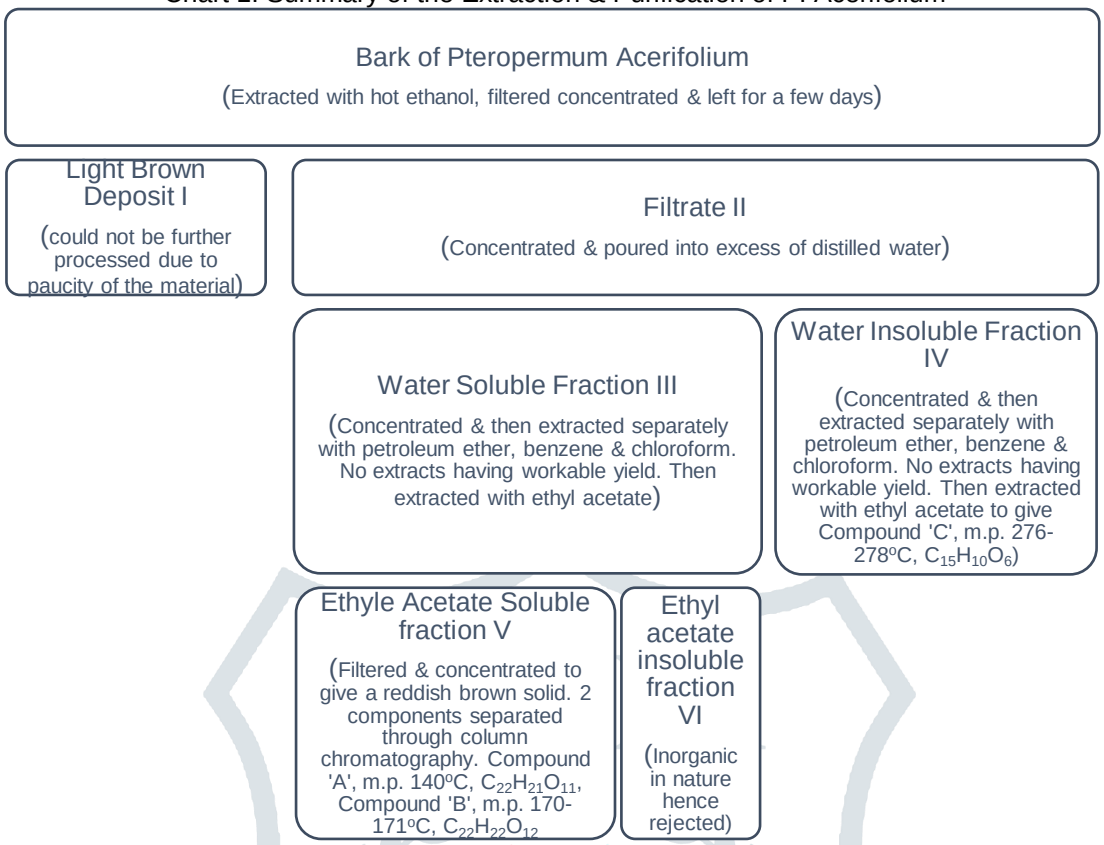
The filtrate obtained after filtering off the water insoluble fraction was concentrated to a small volume and was successively extracted with various increasingly polar organic solvents in a liquid-liquid extractor. It was extracted with petroleum ether, benzene, and chloroform successively using a liquid-liquid extractor, but no compound was obtained. The filtrate was then extracted with ethyl acetate. On concentration of the ethyl acetate extract a reddish-brown solid was obtained which was found to be a mixture of a number of compounds by chromatographic examination on thin layer chromatoplates of silica gel ‘G’. Two components were separated by the column chromatography over the column of silica gel using mixture of organic solvents in order of their increasing polarities. The ethyl acetate: acetone (2:1 v/v) eluted fraction gave a yellow compound designated as compound (A) which has been described earlier.

The ethyl acetate: acetone (1:9 v/v) eluted fraction also gave a yellow compound designated as compound (B) which has been described earlier in this chapter. The compounds were examined chromatographically on paper chromatograms and thin layer chromatoplates of silica gel ‘G’ and were found to be a single compound.

The residue obtained on adding ethanolic concentrate to excess of distilled water was washed well with distilled water to remove water soluble impurities. The washings were discarded and the solid mass was dried.

The dried mass was then refluxed successively with various organic solvents. On concentration of the ethyl acetate extract a reddish- brown solid was obtained which was found to be a mixture of several compounds by chromatographic examination on thin layer chromatoplates of silica gel ‘G’. One component was separated by the column chromatography over the column of silica gel using mixture of organic solvents in order of their increasing polarities. The benzene: Ethyl acetate (6:4 v/v) eluted fraction gave a yellow compound designated as compound (C) which has been described earlier.

Chart 1: Summary of the Extraction & Purification of P. Acerifolium



3.Results & Discussion

The 3 compounds were purified through column, thin layer, & paper chromatography processes. Further, standard reagent tests to identify functional groups were done to these extracted compounds. Additionally, Rast's method was used to determine the elemental composition of the compounds, followed by UV & IR spectroscopies (NMR spectroscopy as well, wherever required) to further analyze the functional groups.

The results are summarized below:

	Compound 'A'	Compound 'B'	Compound 'C'
Test Observations	- Aglycone with flavone nucleus [4-6] -3 hydroxyl groups -Hydroxyl group at position 3 (flavonol) [7-12] -Methoxyl group [13] -Only 1 monosaccharide unit	- Aglycone with flavone nucleus [4-6] -4 hydroxyl groups [14] -Hydroxyl group at position 3 (flavonol) [7-12] -Methoxyl group [13] -Glycoside	-Aglycone with flavonoid nucleus [4-6] -No alkoxyl or alkyl groups identified [13] -4 hydroxyl groups [14] -Hydroxyl group at position 3 (flavonol) [7-12] -Reducing group of sugar has a glycosidic linkage

Identified Structure	3,5 dihydroxy-4'-methoxy-flavone-7-o- β-D-glucopyranoside	Methyl ether of quercetin-3-o-β-D-galactopyranoside	Kaempferol

The study revealed the 3 key compounds of P. acerifolium & these can be potentially considered for further evaluation of their applications. Combined with the several active phytochemical components, P. acerifolium can be taken up as a candidate for further scientific exploration for its hidden curative & therapeutic potential.

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