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INVESTIGATE THE PHYTOCHEMICAL AND PHARMACOGNOSTICAL POTENTIAL OF *Simarouba glauca* DC.

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ABSTRACT:

Simarouba glauca DC., a dry deciduous flowering tree, is native to Florida, South America, and parts of the United States. It is commonly known as Bitterwood, Dysentery Bark, Lakshmi Taru, and Paradise Tree. The seeds of this tree serve as a source of edible oil, while various parts of the plant are utilized in traditional medicine to address a wide range of ailments. The plant is rich in essential phytochemicals, many of which have significant pharmacological properties. Studies have highlighted its medicinal value, showcasing therapeutic activities such as analgesic, antimalarial, antimicrobial, antitumor, antiulcer, hypoglycemic, insecticidal, stomachic, and vermifuge effects.Among the bioactive compounds identified in Simarouba glauca, the quassinoids, a group of complex terpenes, are noted as the most potent components. Continued research on this plant suggests the potential discovery of novel pharmacophores, which could play a crucial role in enhancing human health and addressing various disorders. This research aims to emphasize the pharmacological importance of Simarouba glauca and establish a foundation for future scientific studies on this promising species.

Key words –: *Lakshmi taru*, edible oil, medicinal value, antitumor.

INTRODUCTION:

Man has understood and applies plants in a wide range of forms over the ages.[1] Plants are quite excellent models of diverse bioactive substances used specifically or indirectly to manage a variety of human disease. Human relied on soothing power of plant species before adding chemical substance. The people respect the plants because of the traditional belief that plants are the sources to provide nutrition, medicinal care and also for other benefits of mankind.[2] WHO stated that the best source of several medicine are extracted from various medicinal plants. Herbal medicines have contributed significantly to public health. This is because traditional remedies have tremendous curing power.[3] Medicinal plants in India are used extensively by all group of populations as a folk remedy as well as various indigenous medical systems or indirectly in modern medicinal products.[4] Phytoconstituents are chemical compounds which are found in plants inherently. Phytochemicals have recently become more common due to their various therapeutic applications. Unlike synthetic chemicals, these phytochemicals have least adverse effects and are important against a variety of respiratory disorders, arthritis, tumour and other diseases. Phytochemicals derived from

various officinal parts of plants including leaves, buds, stem, pulp, seeds and so on.[5] More than 170 species of 32 genera pantropical trees and books belong to Simaroubaceae family. Its quality is distinguished by bitter substance which are mainly accountable for its medicinal properties.[6] *S. glauca* is a dry deciduous floral tree multi-functional edible oil reservoir, popularly known as Shorgum, Maram, Simba, Robleceillo, Pitomba, Poloamargo, Dysentery bark, Bitter wood and Aceituno. In India, *S. glauca* is famous as paradise tree, Shorgum or *Lakshmi taru* which belongs to Simaroubaceae family.[7] This plant is renowned for its pharmacological and therapeutic properties of various kinds. *S. glauca* pharmacological qualities are anticancerous, antidysentery, anthelmintic, antimalarial, antimicrobial, antiparasitic, antipyretic and haemostatic.[8] *S. glauca* leaves, seeds, pulp and fruit are considered to be amenogouge, antiviral, astringent, antimicrobial, vermifuge and stomachic.[9] *S. glauca* extracts are used to treat gastro-intestinal disturbances in Guatemala.[10] The stem bark, the leaves, mesocarp of fruit, root, seed, testa, stem and the branches of the plants are the source of fodder, fuel, fertiliser, wood and medicines.[11] The studies showed that the water extract of leaves of *S. glauca* promotes the cell division of skin, keratinocytes and increases skin moisture and hydration. The product of *S. glauca* are available in the form of skin lotion and dry leaf powder. The dried leaves powder are being used to treat skin diseases.[12] *S. glauca* is a good source of carbohydrates, fatty acids, lipids and proteins. The kernels have edible fat made of oleic, palmatic and stearic acids. While the seeds contain oil, the kernels are rich in essential amino acids namely leucin, lysine and valine. Additionally, the average protein content is 51.8 g/100 g. Alkaloids, calcium, sodium, triterpenoid, aglycone, phenolics and saponins are present in food products derived from this plant.[12]

MATERIALS AND METHODS:

The entire plant of *Simarouba glauca* leaves were obtained from the nearby Uttrakhand areas for this experiment. We collected leaves from Kumaun and Nainital, Uttrakhand localities and Dr. Mohd. Gulfishan, Assistant Professor, From Department of Botany, verified on the basis of Physical and Morphological bases and validated the entire plant. The collected leaves are cleaned with tap water and rinsed with distilled water. Few leaves are preserved in FAA for microscopic studies and rest of the leaves are shade dried and powdered, sieved and stored in airtight containers for further pharmacognostical studies. Preserved plant samples was used for free hand sectioning of leaf for microscopic studies. Aniline blue was used to stain the material and mounted on glass slide with glycerine.[13] The powdered drug was subjected to primary phytochemical analysis to evaluate the presence of various phytochemical constituents in the plant. The drug is subjected to qualitative phytochemical analysis to evaluate the presence of different phytochemical constituents in the plant. The physicochemical studies that is loss on drying, foreign matter, total ash, acid soluble ash, acid insoluble ash were carried out according to the standard procedures as per the API.[14]

Priliminary phytochemical studies were carried out by following the Mayer's test for alkaloids, Molisch's test for carbohydrates, Keller Kiliane test for cardiac glycosides, Shinoda test for flavonoids, ferric chloride test for phenols and tannins, froth test for saponins, Salkowski's test for triterpenoids (according to API).[14]

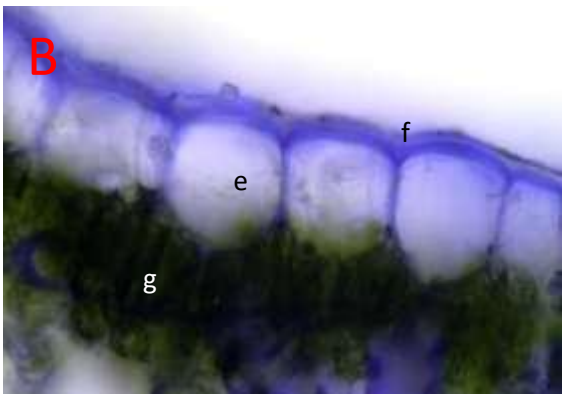
TLC plate is prepared and the drug is loaded on plates as per the standard procedure. Toluene and ethyl acetate in the ration 9:1 are used as a stationary phase. Spots are observed under short and long wave lengths. Rf value was calculated by dividing the distance travelled by the spot and the distance travelled by the mobile phase.[14]

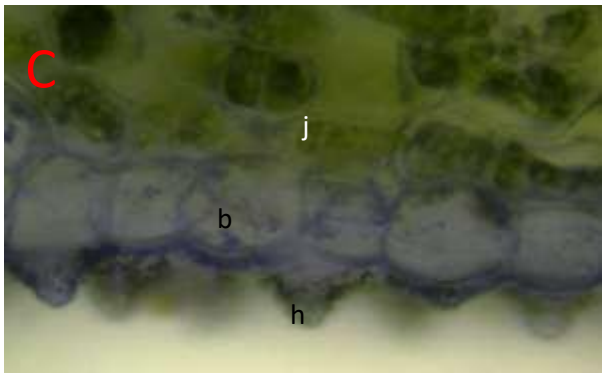
RESULTS:

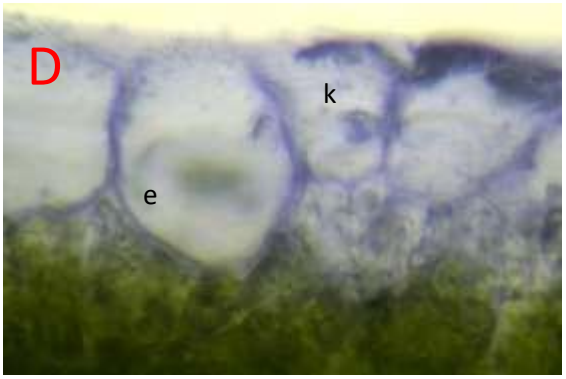
I. Macroscopic study

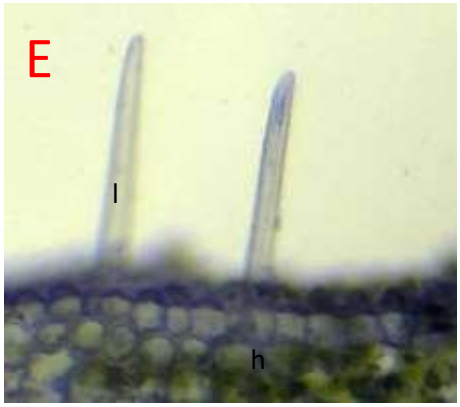
Leaves are alternate; unipinnately imparipinnate; rachis is long, measure about 19-30 cm long with basal pulvinous, slender, flexible. Leaflets are 5-6 pairs; arranged on both the sides of the rachis on alternate portions, with odd number of leaflets. Individual leaflets are having very short petiole with pulvinous base; oblong, obtuse; entire; glabrous; leathery. Dorsal surface is dark green; ventral is dull green in colour. Venation is pinnately reticulate convergent.

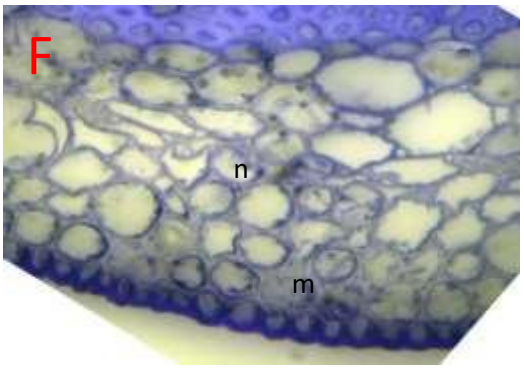
II. MICROSCOPIC STUDY OF LEAF



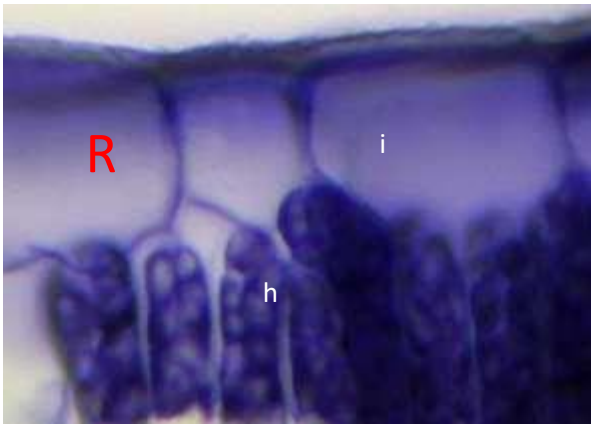


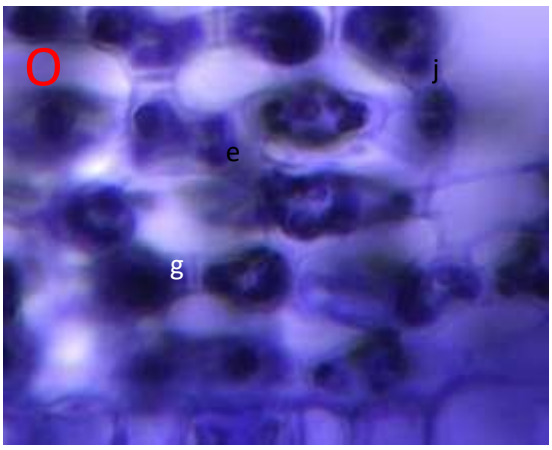


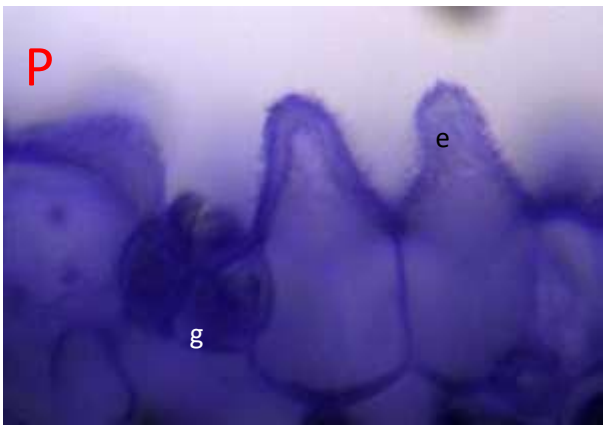




A.Cross section of leaf, B. Upper epidermis, C. Lower epidermis, D.stomata, E. Trichomes, F.Lower epidermis at midrib region .a. upper mid rib ,b.Lower mid rib, c.laminar region, e.upper epidermal cell, f.cuticle, g.palisade cells, h.Lower epidermal cell i.protruberence of epidermal cell, j.spongy cells,k.Stomata,l.Trichomes,m.Collenchyma cells, n.parenchym

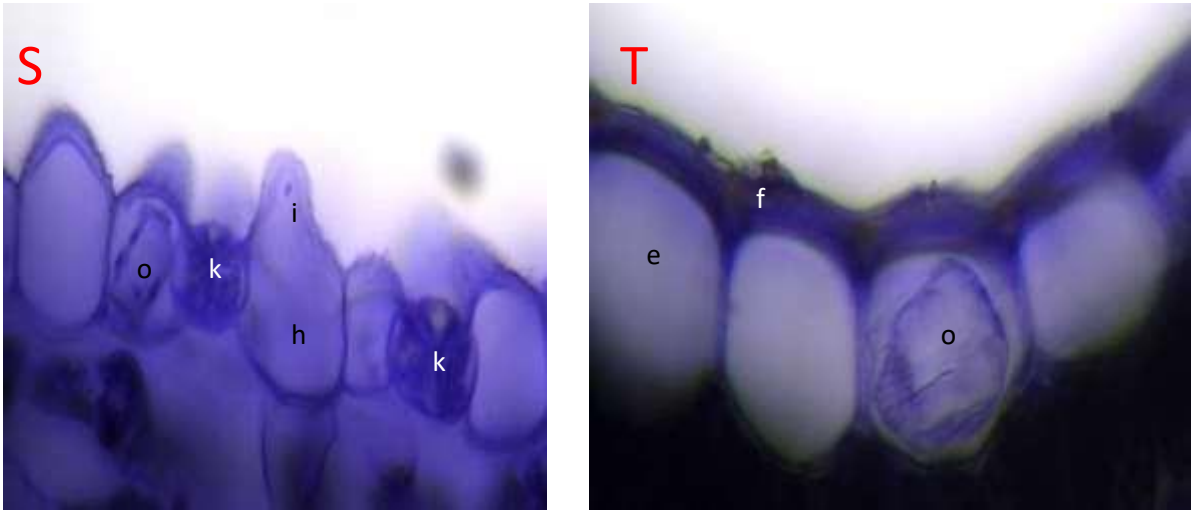






M.Laminar region, N.Mesophyl, O.Upper part of mesophy l,P.Palisade part, Q.Spongy part, R.Lower

epidermal part, h. Lower epidermal cell,J,Spongy cells, w, Astrosclereid, K.Stomata,h,Lower epidermal cells,i.Out growth of epidermal cells.



S.Lower epidermis, T.Upper epidermis.o.calcium oxalate crystals, k,Stomata, h.Lower epidermis,i.Lower epidermal out growth,e.Upper epidermal cell, f.Cuticle.

VERTICAL TRANSVERSE SECTION OF LEAF:

Vertical transverse section of leaf at mid rib region shows mesophyll tissue bounded by a upper and lower epidermal layers. Upper epidermal layer is made up of somewhat ovular to tangentially elongated cells covered by cuticle and unicellular trichomes, interrupted by stomatal openings, Lower epidermis is also a single layer made up of ovular shaped cells with growth at laminar part but outgrowth is absent at midrib part of ventral side. The lower epidermis is also interrupted by stomata. Calcium oxalate crystals are present in both the upper and lower Mesophyll is differentiated into palisade parenchyma and spongy parenchyma. Palisade parenchyma lies below the upper epidermis and Cells are elongated, columnar shaped arranged in 2-3 layers with plenty of chlorophyll pigments arranged in two columns within the cells. Astrosclereid are irregularly branched, and the spongy tissue lies above the lower epidermal layer with lots of air spaces between the cells. Palisade layer is extended from laminar region from both the side to the certain part of midrib.

Midrib portion is convex on both the side, below the epidermal layer is a compactly arranged 3-5 layers of collenchymas cells followed by loosely arranged parenchyma cells at the midrib part. At the centre of the section there is well developed vascular bundle, surrounded by a patch of arc shaped sclerenchyma tissue on both the side of vascular bundle. There are three smaller vascular bundle at the centre which is also surrounded by the sclerenchyma. Xylem and phloem are well differentiated from each other. Xylem vessels, xylem fibres and xylem parenchyma are very clear in the section.

III. Physicochemical analysis:

Table 1 - Physicochemical evaluation:

Sl.No.	Parameters	Result
1.	Determination of foreign matter	1.8%
2.	Loss on drying	8.6%
3.	Total Ash	35.66%
4.	Acid insoluble ash	0.153%
5.	Water soluble extractive	35%
6.	Alcohol Soluble extractive	41%

IV. Table 2 - Preliminary phytochemical analysis:

Sl. No.	Phytochemicals	Test	Result	Inference
1	Alkaloids	Mayer's test	Pale greeny precipitate	Positive
2	Carbohydrates	Molisch test	Reddish violet ring	Positive
3	Cardiac glycosides	Keller Kiliane test	No greenish blue colour	Negative
4	Flavonoids	Shinoda test	Reddish brown colour	Positive
5	Phenols	$FeCl^2$ test	No dark green / blue colour	Negative
6	Saponins	Frothing test	No stable froth	Negative
7	Tannins	$FeCl_2$ test	No blue-green or blue-black colour	Negative
8	Triterpenoids	Salkowski test	Reddish brown colour	Positive

V. Thin Layer Chromatography:

Table 3

Solvent system	Toluene: Ethyl acetate (9:1)
Thin Layer Chromatography	Rf values
	0.81-pale yellow
	0.53-pale green
	0.48-grey
	0.43-yellow
	0.33-grey
	0.18-yellow
	0.15-yellow
	0.12-green

Discussion:

Leaves are unipinnately compound. The cross section of the mid rib of leaf is taken and the section of leaf shows, upper epidermis, lower epidermis, stomata, trichomes. Lower epidermis at midrib region shows upper mid rib ,Lower mid rib, laminar region, upper epidermal cell, cuticle, palisade cells, lower epidermal cell, protruberence of epidermal cell, spongy cells, stomata, trichomes, collenchyma cells, parenchyma. Laminar region shows mesophyl, upper part of mesophyl, palisade part, spongy part, lower epidermal part, lower epidermal cell, spongy cells, astrosclereid, stomata, lower epidermal cells, out growth of epidermal cells. Lower epidermis, upper epidermis, calcium oxalate crystals, stomata, lower epidermis, lower epidermal out growth, upper epidermal cell, cuticle are present. When the plant is subjected to analysis it is found that, less foreign matter was seen as the plant is directly collected and dried in lab. On drying, the loss was 8.6%, it is found that more quantity of inorganic residue is found i.e., about 35.66% and it is found that water soluble percentage of ash is 35% and insoluble 0.153g. Similarly, acid soluble is 41% and insoluble is 0.153g and the retention factor is 0.5%. Phytochemical studies showed positive results of alkaloids, carbohydrates, flavonoids and triterpenoids which reveals that it is useful in the treatment of amoebiasis, malaria, diarrhoea, cancer. The leaves contain flavonoids, phenolics and tannins that help to battle conditions like cancer, diabetes and other diseases.[12] Thin Layer Chromatography of *S. glauca* showed the different Rf values for 8 different secondary metabolites. So, the present study showed that the *Lakshmi taru* leaves has various phytochemicals act as active principles having different pharmacological action including insecticidal, antimicrobial and other properties. It may be used for the production of different plant-based medicines and also there is a scope to work to improve the quality and quantity of these value added products derived from this plant. Marker based selection can be done to achieve maximum therapeutic activity of specific plant components.

Conclusion:

Microscopic analysis has identified the presence of astroscleroids as a unique characteristic for the authentication of this medicinal plant. Physicochemical parameters, including ash value, acid-insoluble ash value, and water- and alcohol-soluble extractive values, serve as key pharmacognostical standards for this

drug. Further investigations into this species suggest the potential discovery of novel pharmacophores that could contribute to improved human health and the treatment of various diseases. The leaves of *Simarouba glauca* are rich in triterpenes, which are effective in treating conditions such as amoebiasis, diarrhea, and malaria. Additionally, quassinoids have shown promising antitumor activity. The presence of alkaloids, carbohydrates, flavonoids, and terpenes constitutes the primary active principles responsible for the plant's pharmacological properties. Rf values play a critical role in the standardization of this drug. Continued research is essential to isolate and characterize these active principles, paving the way for the development of standardized formulations to enhance human health in the modern era.

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