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Morphological, Anatomical Studies and Phytochemical Screening of Rhizome-Nelumbo Nucifera, Gaertn.; (Family- Nymphaeaceae)

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Abstract: Plants that possess therapeutic properties or extracted beneficial pharmacological effect on human body are generally designated as medicinal plants.

Plants naturally synthesize and accumulate some secondary metabolites like alkaloids, sterols, terpenoids and flavonoids. Plant morphology or phytomorphology is the study of external features like, development, form and structure of a plant. It observes both the vegetative as well as the reproductive structures of plants. Plant anatomy investigates at the cellular level, and often involves the sectioning of tissues and microscopy.

Phytochemicals are the chemicals that are present naturally in plants. Nowadays the phytochemicals become more and more popular due to their important medicinal uses. The medicinal properties of phytochemicals play a vital role in many treatments for diseases.

The phytochemicals do not have any side effects like the other pharmaceutical medicines have. *Nelumbo nucifera* Gaertn. (Nymphaeaceae), also known as sacred lotus, is a well known medicinal plant.

The present study is to analyze the morphological and anatomical features of pink lotus and the phytochemical screening of rhizome.

Keywords: *Nelumbo*, Anatomical, Morphological, Rhizome, Phytochemical screening

I. INTRODUCTION

Phytochemistry deals with the knowledge of bioactive natural products or phytochemicals isolated from natural products. They have a beneficial effect on human health and play an important role in the treatment of diseases.

Conservation and sustainable use of medicinal plants are issues on which immediate focus is required in the context of conserving biodiversity. All parts of *N. nucifera* have been used for various medicinal purposes in various systems of medicine including folk medicines, Ayurvedic, Chinese traditional medicine, and oriental medicine.

Lotus is one of the most popular water plant grown almost in every part of the world. They are astringent, cardiotonic, febrifuge, hypotensive, resolvent, stomachic, styptic, tonic and vasodilator. In some research reports, the lotus can control the temperature of itself just like humans and animals do.

The roots of the Lotus are planted in the soil of the pond or river bottom, while the leaves float on top of the water surface. The Lotus flowers are usually found on thick stems rising several centimeters above the water.

The morphological characters of plants can be used to compare, measure, count and describe the differences or similarities in plant taxa and use these characters for plant identification, classification and descriptions. Plant anatomy or phytotomy is the study of the internal structures of plants.

II. MATERIALS AND METHODS

A. Study Area: (Plate 1 and 2)

Thirunavaya is a town situated 8 km south of Tirur in Malappuram district, Kerala. Yearly average rainfall of the census town is 2769 mm. Maximum temperature here reaches up to 32°C and minimum temperature goes down to 25°C. The north-west monsoon season is between October-November. Soil type is loamy sand soil.

Plate: 1- Location map

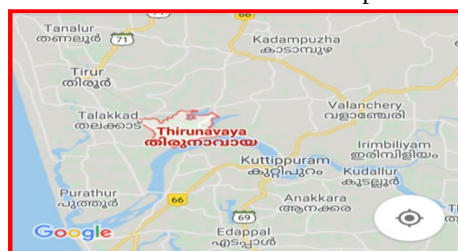


Plate: 2- Study area



B. Selected Sample: (Plate-3)

For the present study the sample is selected from Thirunavaya town, Malappuram, to find out the phytochemical activities with morphological and anatomical features. The whole plant is collected for the study. Plant sample were collected during in the month of November. After collecting, the plant sample is washed gently under tap water to remove mud and small water bugs.

Nelumbo nucifera, Gaertn

Plate: 3- Habit of selected sample

Systematic Position

Kingdom : Plantae

Clade : Angiosperms

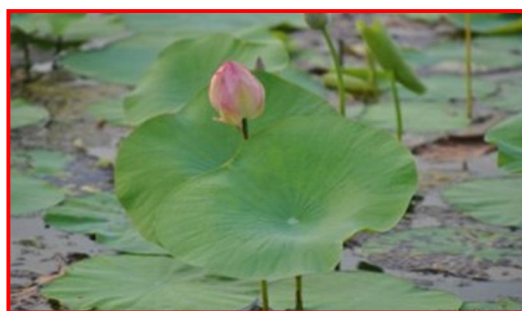
Clade : Eudicots

Order : Proteales

Family : Nelumbonaceae

Genus : *Nelumbo*

Species : *N. Nucifera*



C. Plant Description

- 1) **Distribution:** *N. nucifera* Gaertn. is native to Asia and flourishes in a wide range of climates from India to China. It is commonly called as sacred Lotus, Indian Lotus and sacred water-lily. The roots are implanted in the soil of a river or pond, and the leaves float on the surface.
- 2) **Uses:** The Lotus stem is eaten almost in all parts of India, and pickled too. It was used in the treatment of diarrhea, tissue inflammation and homeostasis. The Lotus flowers, seeds, young leaves and rhizomes are all edible. In Asia, the petals are sometimes used for garnish, while the large leaves are used as a wrap for food. Various parts of the sacred Lotus are also used in traditional Asian herbal medicine.

D. Morphological Observation

After collecting, the plant sample is washed gently under tap water to remove mud and small water bugs. After proper washing, the plant parts are separated carefully using sharp knife and observed their morphological characters well using a hand lens and simple microscope.

E. Anatomical Observation

After morphological observation, each plant part is taken out small and thinnest sections which are stained using Safranin. The stained sections are well observed under compound microscope. The perfect sections are mounted using glycerin and put on a cover glass for further observation.

F. Preliminary Phytochemical Analysis

- 1) **Preparation of the extract: (Plate-5& 6):** Fresh rhizomes were washed well with running tap water to remove dirt and mud from it and cut into small pieces were dried. The dried samples were powdered using an electrical blender. Fine powder was made transferred into air tight containers with proper labeling for further analysis. 15 grams of the powdered sample was extracted with 100 ml of ethanol and methanol solvents in the shaker system for 48 hours. Then the results were noted and tabulated.

The phytochemical screening of rhizomes with ethanolic and methanolic extract of *N. nucifera* were analyzed by standard methods and it showed various phytochemical constituents (Harbone, 1984 and Wagner *et al.*, 1984).

III. RESULTS AND DISCUSSION

PHYTOCHEMICALS	REAGENT	INDICATION
Carbohydrates	2 drops of Molish reagent, 2 ml conc. sulphuric acid	A brick red precipitate
Proteins	3% NaOH & few drops of 1% CuSO ₄	Solution turns from blue to purple
Amino acid	Few drops of 40% NaOH & 10% lead acetate	Black precipitate
steroids	2 ml chloroform & 2 ml conc. sulphuric acid	Red chloroform layer & greenish yellow acid layer
Glycosides	Glacial acetic acid, few drops of 5% ferric chloride & conc. sulphuric acid	Reddish brown coloration at the junction of 2 layer & bluish green upper layer
Flavonoids	Few drops of 1% ammonia solution	Yellow coloration
Alkaloids	5 ml of 1% aq. HCL & 1ml Mayer's reagent	Yellow colour precipitate
Tannis	1-2 drops of ferric chloride	Blue colour-Gallic tannin
Saponins	2 ml distilled water	Persistent foam
Terpenoids	2 ml chloroform, 3 ml conc. sulphuric acid	Reddish brown precipitate

Table -1 Morphological characters of selected sample *Nelumbo*

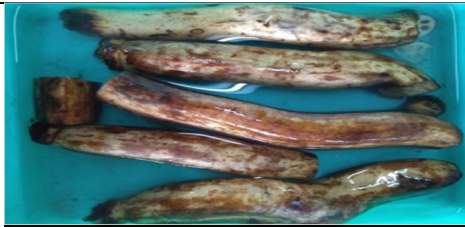
S.No	Plant Parts	Morphological characters	Image
1	Rhizome	-Modified subterranean stem -Petioles, peduncles and roots are sending out from its nodes. -75-100cm long. -1-5 cm in diameter -Yellowish white to yellowish brown in colour.	
2	Leaf	-Light green to dark green in colour -Thin leaves. -50-70 cm in diameter. -Smooth waxy coating upon it. -Circular to oblong in shape. -Leaf blade float on the water surface.	
3	Flower	- Pinkish to white in colour. -It has long peduncle. -15- Many tepals are present. -Bright yellow receptacle and stamens. -15-35 short styles.	
4	Fruit	- Oblong- ovoid conical pod. -Light green in colour. -There are numerous pores. -3-5 cm long with 1-4 cm diameter	

Table- 2 Anatomical characters of the selected sample *Nelumbo*

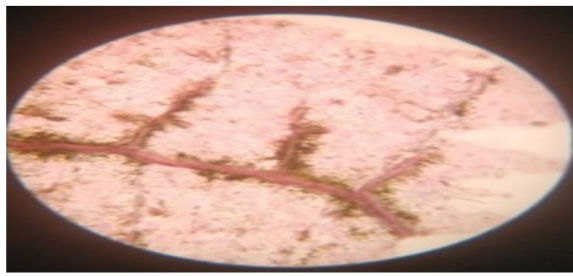
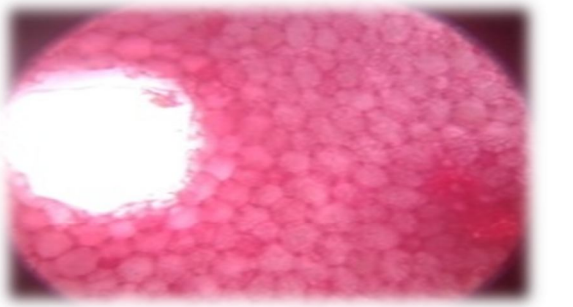
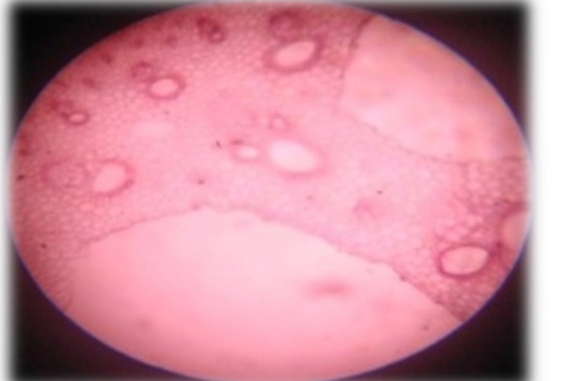
S. No	Plant Parts	Anatomical characters	Image
1	T. S of Leaf	-Outer epidermis. -Whole surface covered with short wax tubules.	
2	L. S of Petiole	-Outer epidermal layer. -Dense sub-epidermal layer. -Inner spongy layer. -Innermost parenchymatous cells.	
3	L. S of Rhizome	-Outer epidermal layer. -Dense sub-epidermal layer. -Inner spongy layer. -Innermost parenchymatous cells.	

Table -3 phytochemical analysis of Rhizome

S. No	Phytochemical constituents	Ethanol extract	Methanol extract
1	Carbohydrates	+	+
2	Proteins	+	+
3	Amino acids	+	+
4	Steroids	-	-
5	Glycosides	-	-
6	Alkaloids	-	-
7	Tannins	+	+
8	Flavonoids	-	-
9	Saponins	+	+
10	Terpenoids	+	+

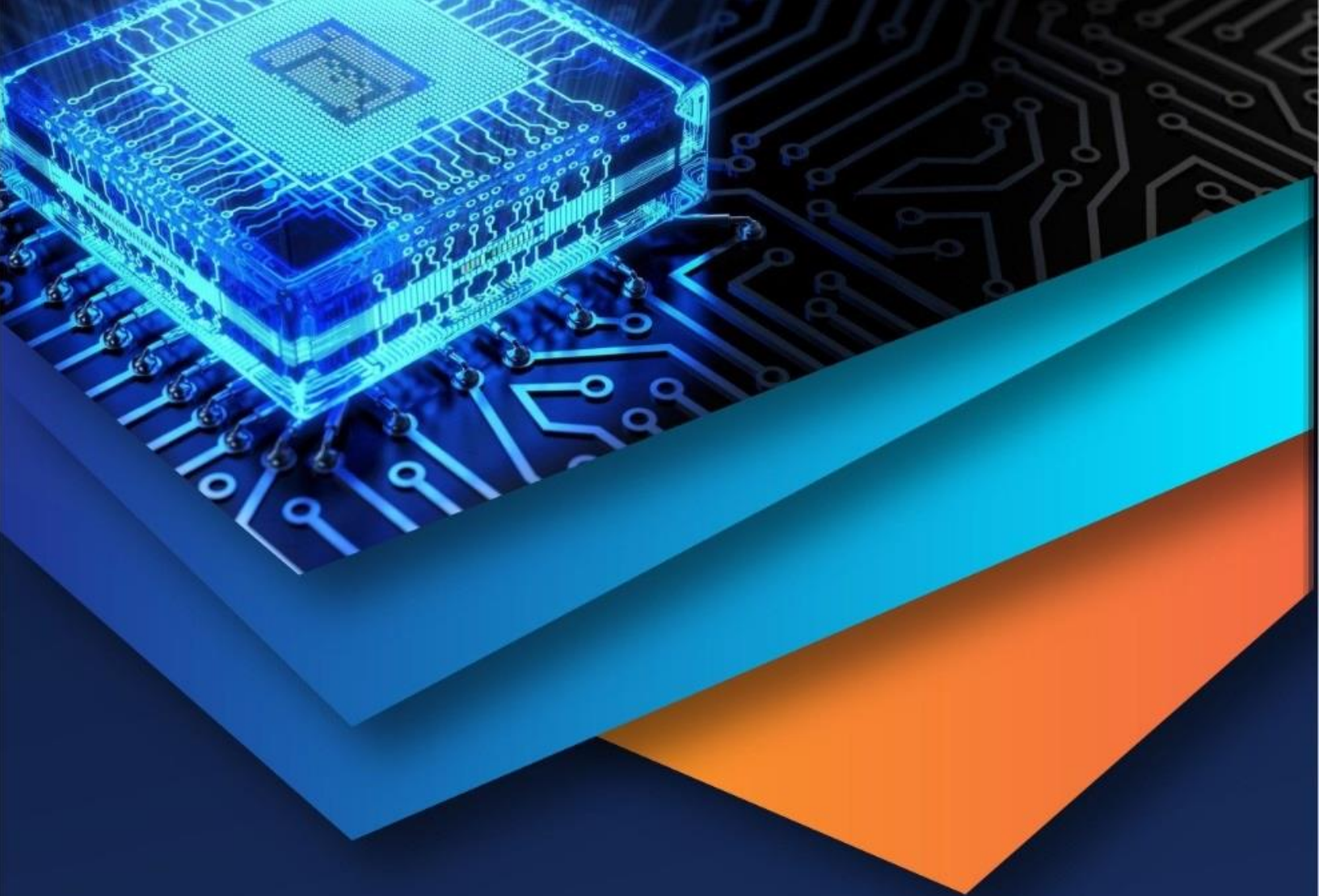
+ indicates the presence of constituents, - indicates the absence of constituents

IV. CONCLUSION

The selected sample is an aquatic perennial and its close morphological observation shows water repellent leaves which float above the water level using its long petiole. The anatomy of both petiole and rhizome are mostly similar. The plant has many medicinal values and it is used in many medicinal preparations. The Lotus stem is eaten almost in all parts of India, and pickled too. It was used in the treatment of diarrhoea, tissue inflammation, and homeostasis. Phytochemical analysis of lotus rhizome were done to identify the presence of many active constituents like carbohydrate, protein, amino acid, steroids, glycosides, alkaloids, tannins, flavonoids, saponins and terpenoids. The ethanol extract of the rhizome showed the presence of carbohydrates, proteins, amino acids and terpenoids. Steroids, glycosides, alkaloids and flavonoids were said to be absent. Also in the methanol extract of rhizome showed the presence of same phytochemical constituents. Hence the present study deals with the morphological and anatomical analysis of *Nelumbo nucifera* and preliminary phytochemical analysis of the rhizome. The secondary metabolites are naturally synthesized in almost all parts of the plant body especially rhizome, leaves, flowers, fruits and seeds etc. Common people have to find their way back to the nature and natural medicines. Hence, the present study aims to improve our quality of life, and to increase the social, economical, commercial and aesthetical values of lotus in day to day life. The lotus flowers are much useful in releasing stress, tensions and help to maintain mental health by its attractive appearance. Flower has a sweet fragrance which gives a pleasant atmosphere in religious occasions. There is a large scope for this plant near future to be used in the pharmaceutical industries.

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